CHAPTER 9

Communications and Networks

You sleep with it on, eat with it on, even shower with it on. You have worn it since birth. It actually looks quite fashionable. You have the bracelet model. Your sister has the earring model. Fido has a choker model.

How did prior generations manage without it? Last week, a neighbor fell down the stairs and was knocked unconscious. The computer chip set in her ring sensed a change in her biological chemistry and signaled for help. Rescue workers arrived at her side in ten minutes. While this computer chip is capable of summoning medical assistance, it also can help law enforcement officials immediately locate missing children. Pets no longer are lost. Stolen valuables embedded with these chips instantly are recovered.

Now these chips even communicate with the electronics and devices around you. This is so cool! As you drive toward a subdivision, from the car speakers you hear an announcer say, "John's house is around the corner." When you walk by an ice cream shop, your Web-enabled cellular telephone beeps and displays a coupon for a 30 percent discount on a hot fudge sundae. While strolling through aisles of the local department store, your handheld computer displays sales and manufacturer's rebates. Life is good.

OBJECTIVES

After completing this chapter, you will be able to:

- Define the components required for successful communications
- Identify various sending and receiving devices
- Explain communications applications
- List advantages of using a network
- Differentiate between a local area network and a wide area network
- Understand the various communications technologies
- Identify uses of intranets and extranets
- Explain the purpose of communications software
- Understand the telephone network
- Describe commonly used communications devices
- Identify various physical and wireless transmission media

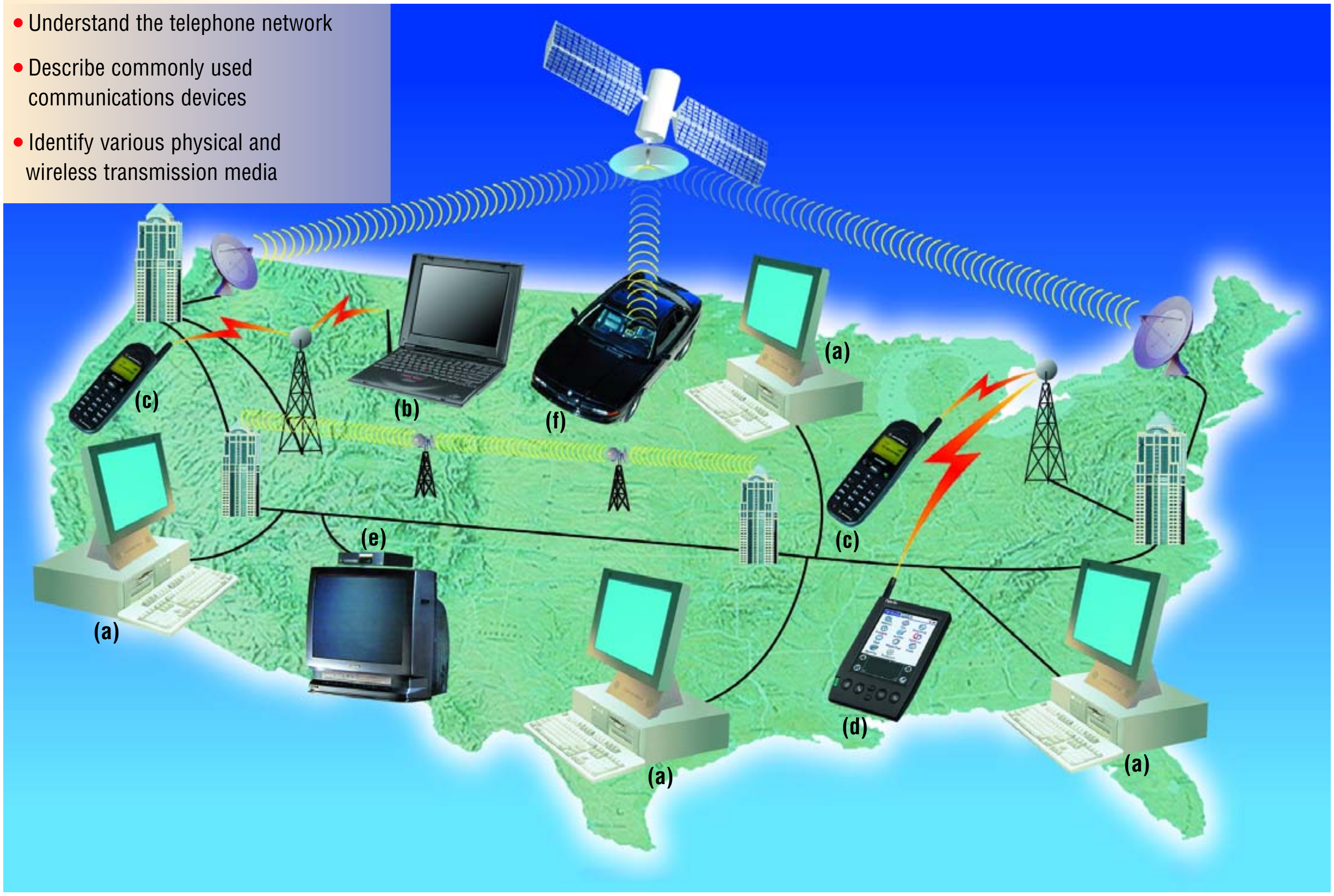
COMMUNICATIONS

Computers were stand-alone devices when first introduced. As they became more widely used, manufacturers designed hardware and software, so one computer could communicate with another. Computer **communications** describes a process in which one computer transfers data, instructions, and information to another computer(s). Originally, only large computers had communications capabilities. Today, even the smallest computers and devices can communicate with one another. Figure 9-1 shows a sample communications system. As illustrated in this figure, communications systems contain all types of devices.

For successful communications, you need the following:

- A **sending device** that initiates an instruction to transmit data, instructions, or information
- A communications device that converts or formats the data, instructions, or information from the sending device into signals carried by a communications channel
- A communications channel, or path, on which the signals travel
- A communications device that receives the signals from the communications channel and converts or formats them so the receiving device can understand the signals
- A **receiving device** that accepts the data, instructions, or information

Figure 9-1 An example of a communications system. Some devices that can serve as sending and receiving devices are (a) personal computers, (b) notebook computers, (c) Web-enabled cellular telephones, (d) Web-enabled handheld computers, (e) WebTV™, and (f) GPS receivers. The communications channel consists of telephone lines, underground cables, microwave stations, and satellites.



The primary function of a communications device, such as a modem, is to convert or format signals so they are suitable for the communications channel or a receiving device. When using a telephone line as the communications channel, you need a modem to convert between analog and digital signals (Figure 9-2). An **analog signal** consists of a continuous electrical wave. Computers, however, process data as digital signals. A **digital signal** consists of individual electrical pulses that represent the bits grouped together into bytes.

For instance, a modem connected to a sending computer converts the computer's digital signals into analog signals. The analog signals then travel over a communications channel, such as a standard telephone line. At the receiving end, another modem converts the analog signals back into digital signals that a receiving computer can understand.

SENDING AND RECEIVING DEVICES

Sending and receiving devices initiate or accept transmission of data, instructions, and information. Notebook computers, desktop computers, mid-range servers, and mainframe computers all can serve as sending and receiving devices. These computers can communicate directly with another computer, with hundreds of computers on a company network, or with millions of other computers on the Internet.

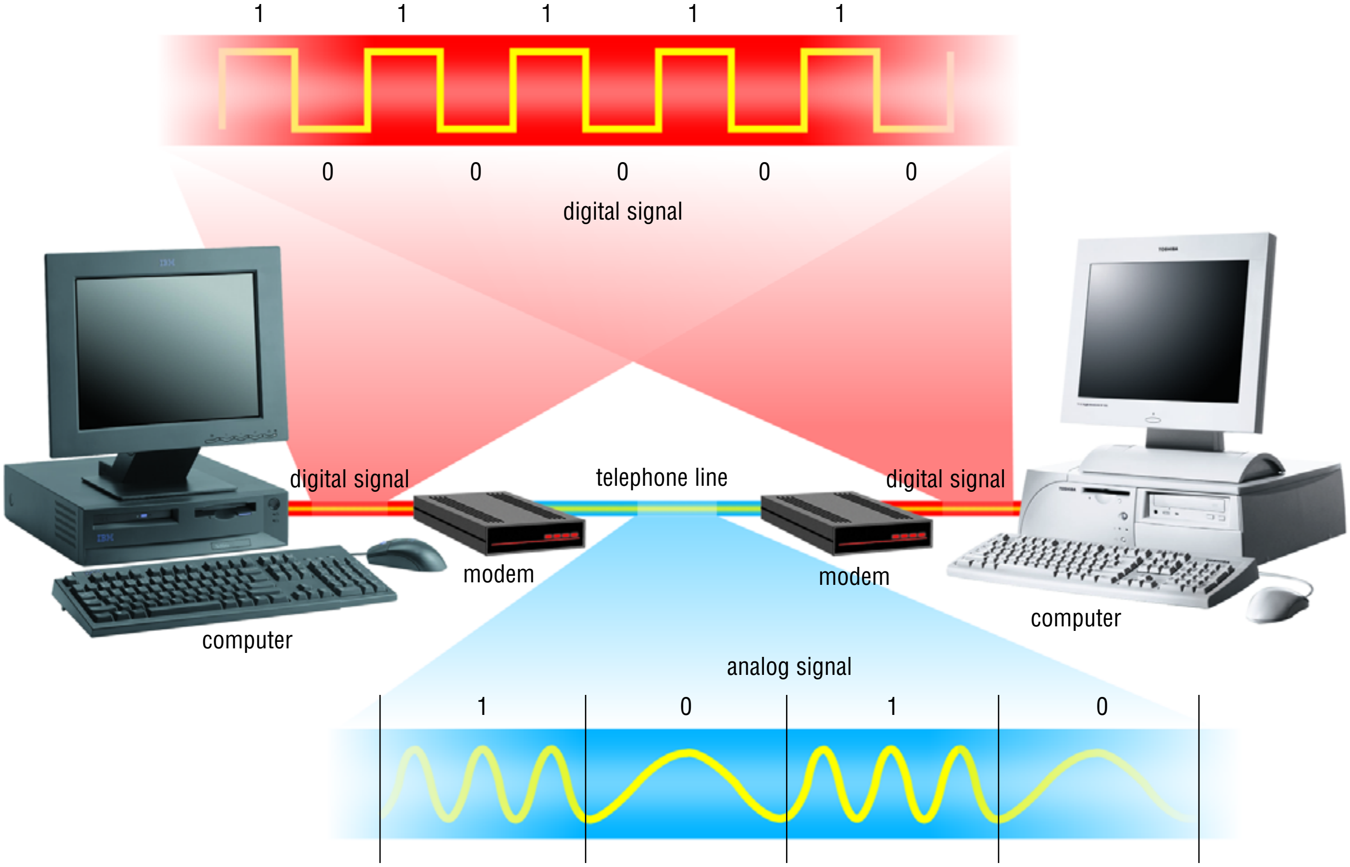


Figure 9-2 A modem converts individual electrical pulses of a digital signal into analog signals for data transmission over some telephone lines. At the receiving computer, another modem converts the analog signals back into digital signals that the computer can process.

Internet appliances and Web-enabled handheld computers and devices also serve as sending and receiving devices (Figure 9-3). An **Internet appliance**, sometimes called a **Web appliance**, is a computer with limited functionality whose main purpose is to connect to the Internet from home. A **Web-enabled device** is a handheld device that provides access to the Internet and e-mail from any location. Cellular telephones and pagers are examples of wireless devices that can be Web enabled.

Internet appliances typically sit on a countertop in the home. With these appliances, you can connect to the Internet in any room of the house. A set-top box, such as WebTV™, sits on top of or next to a television set. You communicate with a set-top box using a remote control or wireless keyboard.

A Web-enabled handheld computer provides Internet access, in addition to the other features normally provided by the computer. A Web-enabled cellular telephone, sometimes called a smart phone, allows you to send and receive messages on the Internet and browse Web sites specifically configured for display on the telephone. A Web-enabled pager, also called a smart pager, is a two-way radio that allows you to send and receive messages using the Internet.

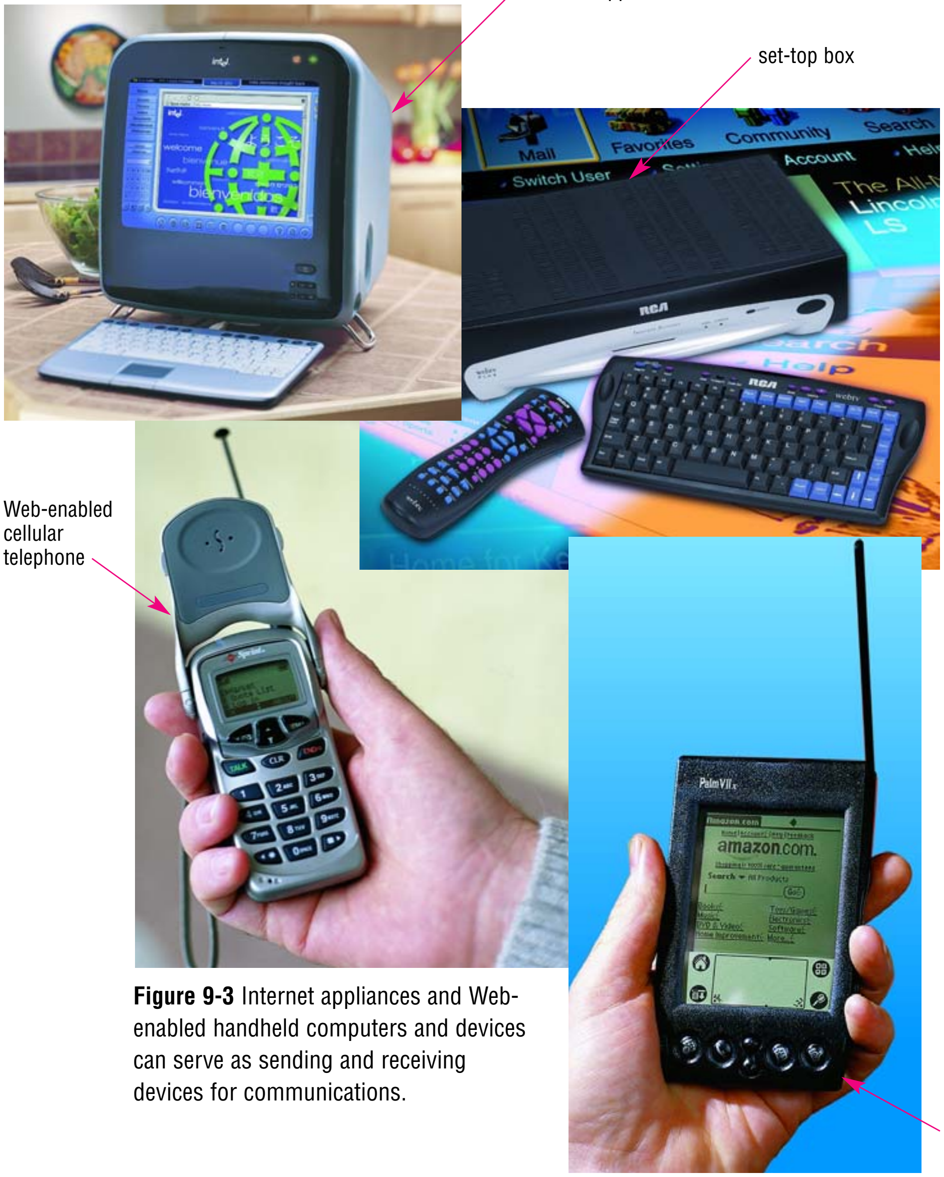


Figure 9-3 Internet appliances and Web-enabled handheld computers and devices can serve as sending and receiving devices for communications.

USES OF COMMUNICATIONS TECHNOLOGIES

Communications technology use is all around you. In the course of a day, for example, you might use, or use information generated by, one or more of the following communications technologies: voice mail, fax, e-mail, instant messaging, chat rooms, newsgroups, telephony, videoconferencing, collaboration, groupware, and a global positioning system (GPS). Previous chapters have presented most of these communications technologies, as they related to a particular topic. The following sections review these technologies and discuss how they specifically relate to communications.

Voice Mail

Voice mail, which functions much like an answering machine, allows callers to leave a voice message for the called party. Unlike answering machines, however, a computer in the voice mail system converts an analog voice message into digital form. Once digitized, the message is stored in a voice mailbox. A **voice mailbox** is a storage location on a computer in the voice mail system.

A voice mail system usually provides individual voice mailboxes for many users (for example, employees in a company or students and faculty at a college). By accessing his or her voice mailbox, a called party can listen to messages, add comments to a message, and reply or forward a message to another voice mailbox in the voice mail system. Some voice mail systems allow you to send the same message to a specific group of individuals or everyone listed in the system's database. Colleges, for example, can use voice mail to notify every student of registration deadlines and weather-related school closings.

Fax

A **fax** can contain handwritten or typed text, illustrations, photographs, or other graphics. As discussed in Chapter 6, you can send or receive a fax using a stand-alone fax machine or a computer fax modem.

Using a computer fax modem is more economical and efficient than a stand-alone fax machine. Not only does it save paper, a computer fax modem allows you to store received faxes on your computer. You then can use an e-mail program to send the fax to others. Many larger companies, such as insurance companies, route all incoming faxes to computer fax modems.

E-Mail

E-mail (**electronic mail**) is the exchange of text messages and computer files transmitted via a communications network such as a local area network or the Internet. Communications devices transfer the e-mail messages to and from computers or terminals on the same network or a separate network. To send and receive e-mail messages, you use e-mail software installed on your computer.

APPLY IT!

Send and Receive Faxes from Your Computer

Throw away the fax machine and use the Internet to send your fax document! Several options are available for receiving and sending fax documents to and from your computer. You can use a fax modem, or you can use one of many Internet services to send a fax. Some are free while others are pay services. Some services require you install special software on your computer.

To use a fax modem requires that you have fax software. Many fax software programs exist — from freeware to shareware to full priced, full featured communications packages. Most of these programs operate similarly. The software installs a specialized driver on your computer. This driver converts electronic documents into the proper format for faxing. You use your modem to transmit the converted documents to a remote fax machine. You can fax any document created in a Windows application or saved in a Windows-compatible format to a remote fax machine or another fax modem.

To send the fax, click File on the menu bar and then click Print to display the Print dialog box. Select your fax software, which displays in the list of printers, and follow the online instructions to send your document. Most of these software programs also support sending copies of paper documents directly from a scanner.

Another option is paperless Internet faxing, which has become popular because it is less expensive to fax through the Internet — no long distance telephone call charges. Receiving faxes through the Internet is convenient. You usually can receive the documents either through an e-mail address or through a Web site. Several companies on the Internet provide this service. One of the more popular is eFax.com (see URL below). To use this free service requires the following steps:

1. Sign up for the free service, which is available for Windows, Linux, UNIX, and Mac users.
2. An e-mail message is sent to you with your fax number and personal identification number (PIN).
3. Download and install the free software that allows you to create, annotate, and send faxes and e-mail messages, in addition to viewing faxes and listening to voice mail messages.
4. For a small monthly fee, you can add other services such as wireless messaging notification and forwarding.

For more information on sending faxes from your computer and the Web site mentioned above, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 9 Apply It #1.

ISSUE

The Nature of E-Mail

E-Mail

E-mail may be today's most popular, and influential, communications technology. It is permeating our writing lives. Millions of people around the world send and receive e-mail messages. E-mail links the geographically separated, connects the socially stratified, enables the physically limited, and encourages the publicly timid. Because of e-mail, people are writing more than ever before — but is it *good* writing? Our grandparents' carefully crafted letters have been replaced by e-mail messages stylistically equivalent to notes on the refrigerator. E-mail's immediacy often results in messages that are ill conceived, casually spelled, poorly worded, grammatically flawed, and tritely expressed (some trite phrases, such as *in my humble opinion*, are used so routinely they are replaced by abbreviations — IMHO). In general, has e-mail's impact on communications been positive or negative? Why? Should the quality of e-mail communications be a reason for concern? Why? Could someone's professional reputation be enhanced or hindered by the quality and effectiveness of their e-mail messages?

For more information on e-mail and the writing process, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 9 Issue #1.

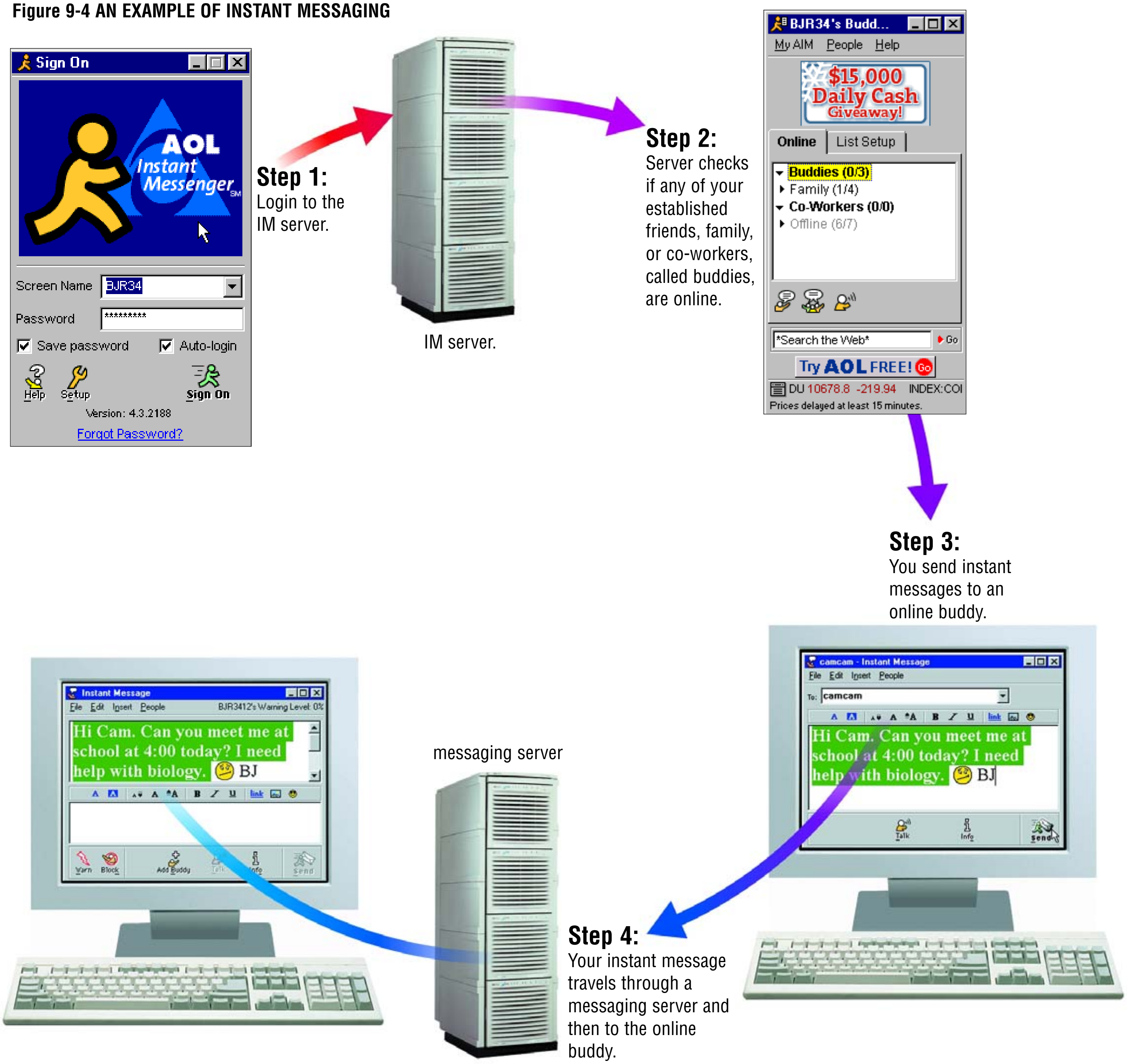
Instant Messaging

Instant messaging (**IM**) is a real-time Internet communications service that notifies you when one or more people are online and then allows you to exchange messages or files with them or join a private chat room. Figure 9-4 shows how to use one IM service. Many IM services also can alert you to information such as calendar appointments, stock quotes, weather, or sports scores. People use IM on all types of computers, including desktop computers, notebook computers, and Web-enabled handheld computers and devices.

Chat Rooms

A **chat room** permits users to converse in real time with each other via the computer while connected to the Internet. To participate in a chat, you and others connect to a server on the Internet. As you type on your

Figure 9-4 AN EXAMPLE OF INSTANT MESSAGING



Screen Name BJR34

Password *********

☑ Save password ☑ Auto-login

To: camcam

Hi Cam. Can you meet me at school at 4:00 today? I need help with biology. BJ

Step 1: Login to the IM server.

IM server.

Step 2: Server checks if any of your established friends, family, or co-workers, called buddies, are online.

Step 3: You send instant messages to an online buddy.

messaging server

Step 4: Your instant message travels through a messaging server and then to the online buddy.

keyboard, a line of characters and symbols display on the computer screen. Others connected to the same chat room server also can see what you have typed (Figure 9-5). In some chat rooms, you can click a button to see a personal profile of someone in the chat room.

Chats typically are specific to a certain topic such as computers or cooking. Some chat rooms support **voice chats** and **video chats**, where you hear and see others and they can hear or see you while in the chat room. **Radio chats** play music while you chat.

Newsgroups

A **newsgroup**, also called a **threaded discussion**, is an area on the Web where users conduct written discussions about a particular subject. The difference between a chat room and a newsgroup is that a chat room is a live conversation. The newsgroup is not. Some people use the term **synchronous** to refer to real-time live communications and the term **asynchronous** to refer to communications that are not real time. Using this terminology, a chat room is synchronous, and a newsgroup is asynchronous.

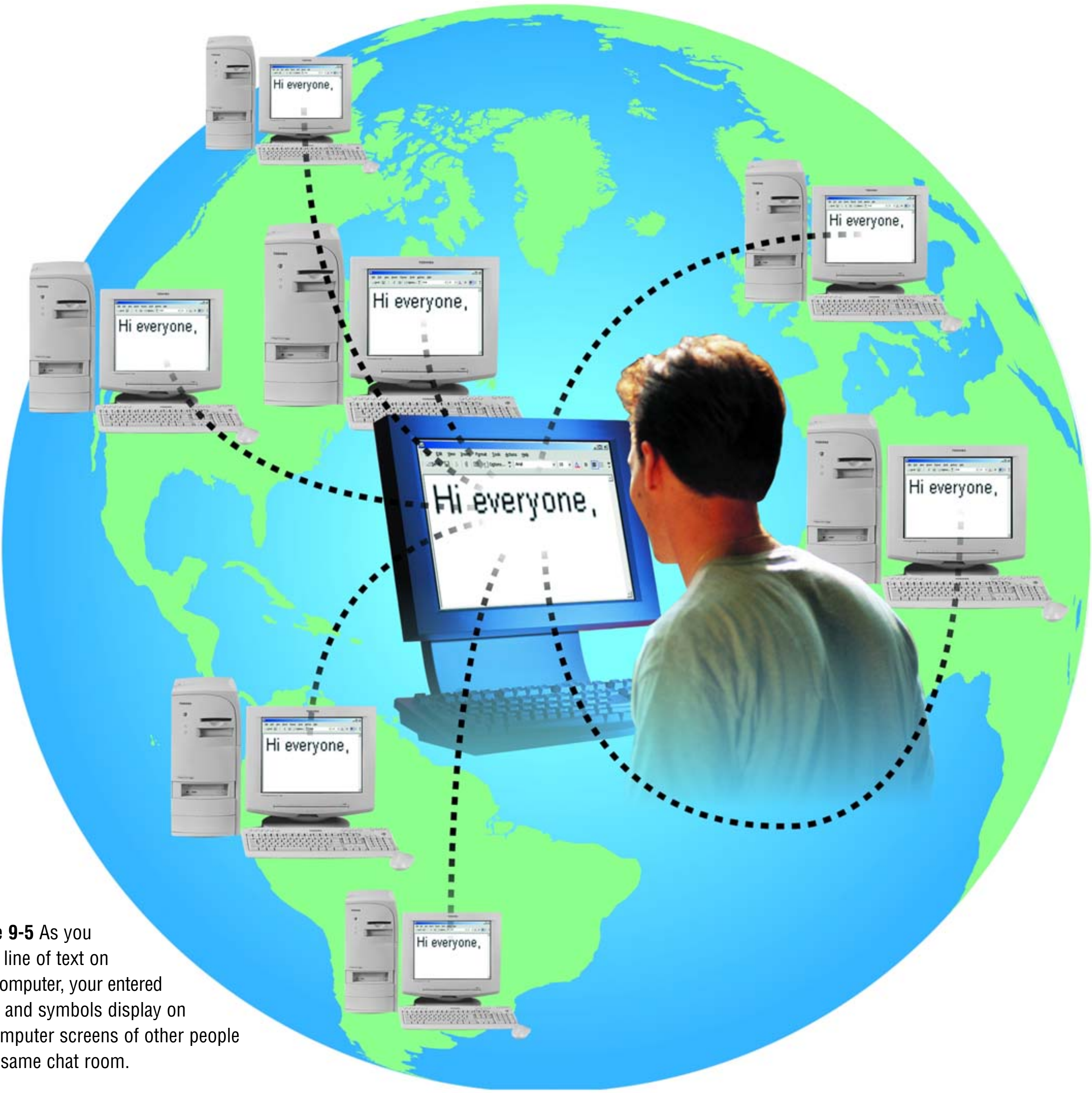


Figure 9-5 As you type a line of text on your computer, your entered words and symbols display on the computer screens of other people in the same chat room.

APPLY IT!

Chat Attack!

Looking for someone to talk to? If so, you can find a chat room to discuss just about any topic. Chat rooms are similar to conference calls; everyone is online at the same time. You can watch the chat without joining it, or you can join the conversation at any time. Some chat sessions are open discussions, while others are moderated by hosts. One of the most popular chat sites on the Web is Yahoo Chat (see URL below).

Before chatting, you should understand how chat rooms work. Chat rooms have their own special cyberlingo and a set of rules (netiquette) for online behavior. In a chat room, you will see many abbreviations, such as the following:

- **AFK** - **A**way **F**rom **K**eyboard
- **BAK** - **B**ack **A**t **K**eyboard
- **BBS** - **B**e **B**ack **S**oon
- **BRB** - **B**e **R**ight **B**ack
- **BBIAB** - **B**e **B**ack **I**n **A** **B**it
- **c-ya** - A quick way to say "see you"
- **<g>** - Grin
- **j/k** - **J**ust **K**idding
- **WB** - **W**elcome **B**ack

How you act and treat others online also is very important. The following Core Rules are from the book ***Netiquette*** by Virginia Shea, also known as Ms. Manners of the Internet (see URL below).

Rule 1: Be polite and courteous
Rule 2: Adhere to the same standards of behavior online that you follow in real life
Rule 3: Monitor postings before you participate
Rule 4: Respect other people's time and bandwidth
Rule 5: Spelling and grammar count
Rule 6: Share expert knowledge
Rule 7: Control your responses
Rule 8: Respect other people's privacy
Rule 9: Don't abuse your power
Rule 10: Be forgiving of other people's mistakes

For more information on chat rooms and netiquette and the Web sites mentioned above, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 9 Apply It #2.

Telephony

Internet telephony enables you to talk to other people over the Internet. Internet telephony uses the Internet (instead of the public switched telephone network) to connect a calling party and one or more called parties. To place an Internet telephone call, you need Internet telephone software. As you speak into a computer microphone, **Internet telephone software** and your computer's sound card digitize and compress your conversation (the audio) and then transmit the digitized audio over the Internet to the called parties. Software and equipment at the receiving end reverse the process so the receiving parties can hear what you have said, just as if you were speaking on a telephone.

Videoconferencing

A **videoconference** involves using video and computer technology to conduct a meeting between participants at two or more geographically separate locations (Figure 9-6). Videoconferencing allows participants to collaborate as if they were in the same room. Popular uses of videoconferencing include technical support, distance learning, job recruiting interviews, and telecommuting.

Conducting a videoconference requires computers with microphones, speakers, video cameras, and communications devices and software. The communications devices and software digitize and compress the video and audio data and then transmit it over a communications channel, such as a standard telephone line.

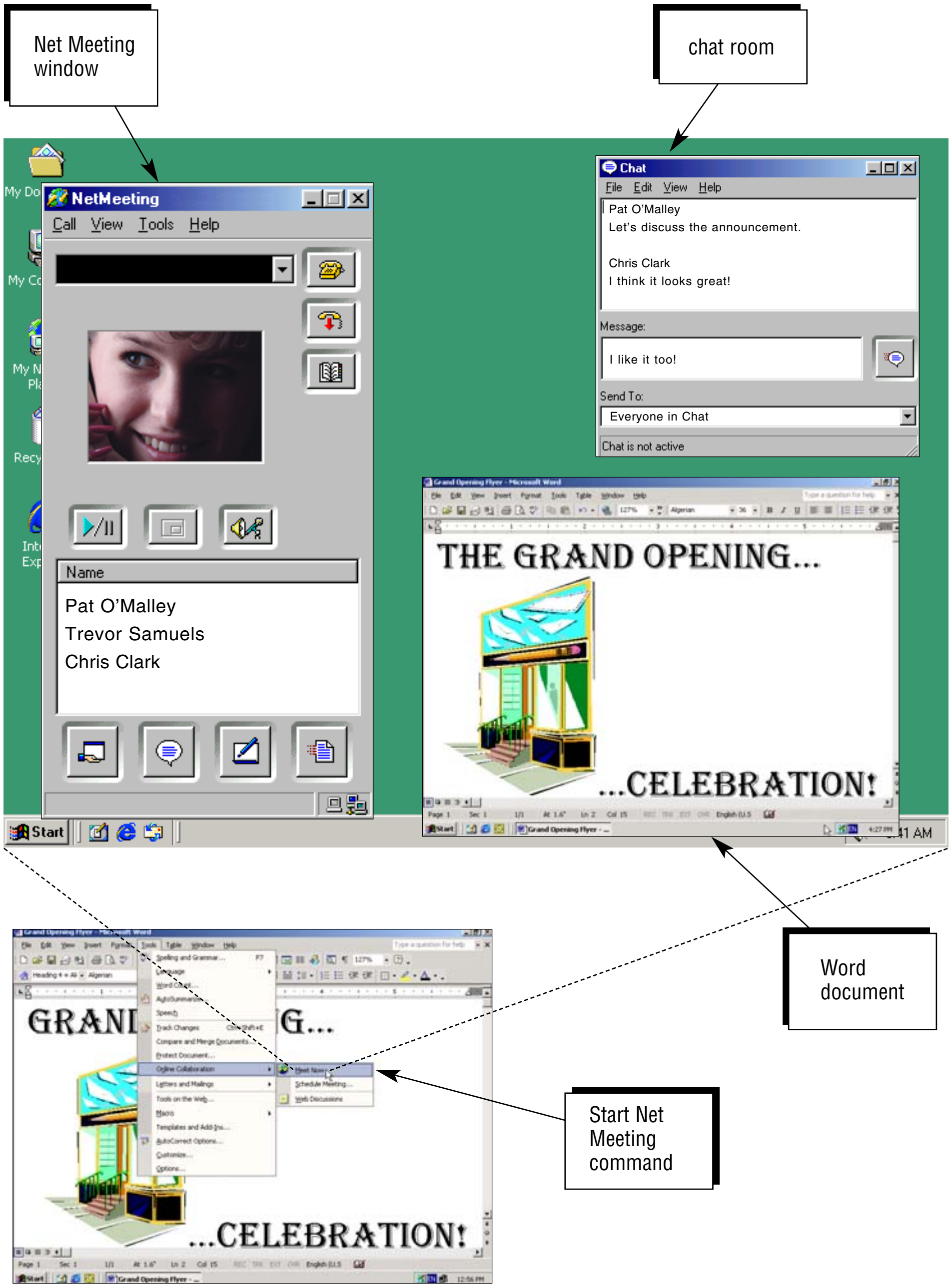
A **Web conference** is a conferencing system that uses the Internet, Web browsers, and Web servers to deliver this service. Using a technology similar to a Web conference, home users today can make a **video telephone call**, where both parties see each other as they talk on the Internet.

Figure 9-6 Videoconferencing allows participants to collaborate as if they were in the same room.

Collaboration

Many software products provide a means to **collaborate**, or work with other users connected to a server. With Microsoft Office, you can conduct online meetings (Figure 9-7). An **online meeting** allows you to share documents with others in real time. All participants see the document at the same time. As someone changes the document, everyone can see the changes being made. During the online meeting, participants can open a separate window and type messages to one another. Some products refer to this window as a chat room.

Instead of interacting in a live meeting, some users collaborate via e-mail. For example, if you want others to review a document, you can attach a routing slip to the document and send it via e-mail to everyone on the routing slip. When the first person on the routing slip receives the document, he or she can add comments to the document. As changes are made to the document, both the original text and the changes display. When each subsequent person on the routing slip receives the document via e-mail, they see all the previous people's changes and can make additional changes. Once everyone on the routing slip has reviewed the document, it automatically returns to the sender.



Pat O'Malley
Let's discuss the announcement.

Chris Clark
I think it looks great!

Message: I like it too!

Send To: Everyone in Chat

Chat is not active

Name
Pat O'Malley
Trevor Samuels
Chris Clark

Figure 9-7 When you start an online meeting from a Microsoft Office product, the participants use NetMeeting to collaborate on the document.

ISSUE

Smile, You're on Video Camera

Public Video Surveillance

Cameras photographing real-time situations are everywhere — on street corners, in parking garages and daycare centers, public buildings, and more. Both public and private organizations use these cameras not only for security, but for a variety of other purposes. One of the most recent implementations of this technology by public agencies is as video watchdogs. On the New Jersey Turnpike, for example, a video system records a four second clip of the arm motion of every driver who pays the toll by tossing change into a basket. A second camera records pictures of the cars' license plates. In many cities, video cameras are installed at intersections to catch speeding motorists and those who run red lights. When someone violates a law, they automatically are sent a ticket. Is this a violation of privacy? Is this ethical? Alan Westin, a Columbia University professor who has studied privacy issues for 40 years, questions how long the tapes will be kept and what safeguards are in place to protect the government from misusing the information. Do you agree that the tapes could be misused? In what way? For how long should a governmental agency be able to keep these tapes?

For more information on video surveillance and privacy issues, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc 2002/ issues.htm**) and click Chapter 9 Issue #2.

Groupware

Groupware is a software application that helps groups of people work together on projects and share information over a network. Groupware is a component of a broad concept called **workgroup computing**, which includes network hardware and software that enables group members to communicate, manage projects, schedule meetings, and make group decisions. To assist with these activities, most groupware provides personal information manager (PIM) functions, such as an electronic appointment calendar, an address book, and a notepad. A major feature of groupware is group scheduling, in which a group calendar tracks the schedules of multiple users and helps coordinate appointments and meeting times.

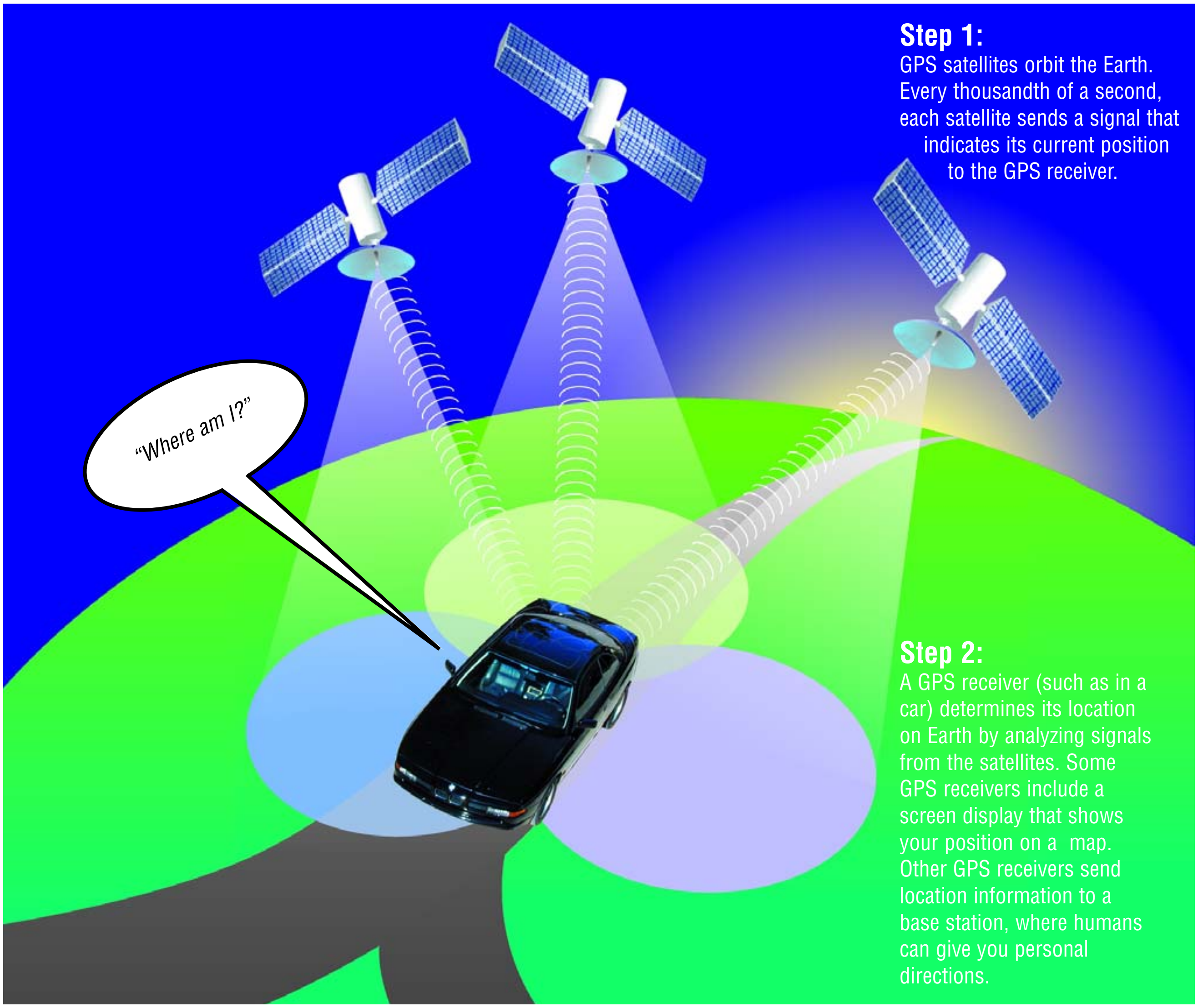
Global Positioning System

A **global positioning system** (**GPS**) consists of one or more earth-based receivers that accept and analyze signals sent by satellites in order to determine the receiver's geographic location. A GPS receiver is a handheld or mountable device, which can be secured to an automobile, boat, airplane, farm and construction equipment, or a computer. Some GPS receivers include a screen display that shows your position on a map. Other GPS receivers send location information to a base station, where humans can give you personal directions.

GPS has a variety of uses: to locate a person or object; ascertain the best route between two points; monitor the movement of a person or object (Figure 9-8); or create a map. GPSs help scientists, farmers, pilots, dispatchers, and rescue workers operate more productively and safely. A rescue worker, for example, might use a GPS to locate a motorist stranded in a blizzard. A surveyor might use a GPS to create design maps for construction projects.

GPSs also are popular in consumer products for travel and recreational activities. Many cars use GPSs to provide drivers with directions or other information, automatically call for help if the airbag deploys, dispatch roadside assistance, unlock

Figure 9-8 HOW GPS WORKS



Step 1:
GPS satellites orbit the Earth. Every thousandth of a second, each satellite sends a signal that indicates its current position to the GPS receiver.

Step 2:
A GPS receiver (such as in a car) determines its location on Earth by analyzing signals from the satellites. Some GPS receivers include a screen display that shows your position on a map. Other GPS receivers send location information to a base station, where humans can give you personal directions.

the driver's side door if keys are locked in the car, and track the vehicle if it is stolen. For cars not equipped with a GPS, drivers can mount GPS receivers on the dashboard or place one in the glove compartment. Hikers and remote campers also carry GPS receivers in case they need emergency help or directions.

A new use of GPS places the device on a computer chip. The chip, called **Digital Angel**™, is worn as a bracelet or chain or woven into fabric and has an antenna that communicates with a GPS satellite. The chip measures and sends biological information to the GPS satellite. If information relayed indicates a person needs medical attention, dispatchers can send emergency medical help immediately. Other possible uses of Digital Angel™ include locating a missing person or pet, tracking parolees, and protecting valuables. Retailers take advantage of this technology, too. For example, a coffee shop could send a coupon into a handheld computer as the people walk by their store.

NETWORKS

A **network** is a collection of computers and devices connected by communications channels that facilitates communications among users and allows users to share resources with other users. Examples of resources are data, information, hardware, and software. The following paragraphs explain the advantages of using a network.

- Facilitating communications — Using a network, people can communicate efficiently and easily via e-mail, instant messaging, chat rooms, telephony, video telephone calls, and videoconferencing. Sometimes these communications occur within a business's network. Other times, they occur globally through the Internet. As discussed earlier in this chapter, users have a multitude of devices available for sending and receiving communications.
- Sharing hardware — In a networked environment, each computer on a network can access and use hardware on the network. Suppose several personal computers on a network each require the use of a laser printer. If the personal computers and a laser printer are connected into a network, the personal computer users each can access the laser printer on the network, as they need it.

  Businesses and home users network their hardware for one main reason. That is, it may be too costly to provide each user with the same piece of hardware such as a printer.
- Sharing data and information — In a networked environment, any authorized computer user can access data and information stored on other computers in the network. A large company, for example, might have a database of customer information. Any authorized person, including a mobile user using a handheld computer to connect to the network, can access this database. The capability of providing access to and storage of data and information on shared storage devices is an important feature of many networks.
- Sharing software — Users connected to a network can access software (programs) on the network. To support multiple user access of software, most software vendors sell network versions of their software. In this case, software vendors issue a site license. A **site license** is a legal agreement that allows multiple users to run the software package simultaneously. The site license fee usually is based on the number of users or the number of computers attached to the network. Sharing software via a network usually costs less than buying individual copies of the software package for each computer.

Web Link

For more information on GPSs, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click GPS.

ISSUE

Implanting Computer Chips

A New Use for Global Positioning Systems

Twenty years ago, bar code technology revolutionized the way goods and merchandise were identified, priced, and inventoried. A new type of electronic identification is now on the horizon. Digital Angel™ (see URL below) is an implanted or worn device that uses miniaturized microchip technology for identification. Unlike the bar code, which requires physical contact between the reader and the bar code, Digital Angel™ uses Radio Frequency Identification (RFID). According to Applied Digital Systems (ADS) (see URL below), the company that manufactures Digital Angel, "The implantable transceiver sends and receives data and can be continuously tracked by GPS (Global Positioning Satellite) technology." The company further states, "When implanted within a body, the device is powered electromechanically through the movement of muscles, and it can be activated either by the 'wearer' or by the monitoring facility." What are the implications of chip implanting? Would you permit a chip to be implanted in your body? Why or why not? ADS promotes this technology as a method to track people on probation, eliminate kidnapping, or locate older people who may get lost. Do you agree? Is this a privacy invasion? What are the ethical issues surrounding this technology?

For more information on the microchip implant and the Web sites mentioned above, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 9 Issue #3.

Local Area Network (LAN)

A **local area network** (**LAN**) is a network that connects computers and devices in a limited geographical area such as a home, school computer laboratory, office building (Figure 9-9), or closely positioned group of buildings. Each computer or device on the network is a **node**. Often, the nodes are connected to the LAN via cables. A **wireless LAN** (**WLAN**) is a LAN that uses no physical wires. Instead of wires, WLANs use wireless media such as radio waves.

A **network operating system**, also called a **network OS** or **NOS** (pronounced nauce), is the system software that organizes and coordinates the activities on a local area network. Some of the tasks performed by a NOS include the following:

- Administration – adding, deleting, and organizing users and performing maintenance tasks such as backup
- File management – locating and transferring files
- Printer management – prioritizing print jobs and reports sent to specific printers on the network
- Security – monitoring and, when necessary, restricting access to network resources

Many operating systems have network features built into them. In other cases, the network OS is a set of programs that works with another operating system(s). Figure 9-10 indicates which operating systems

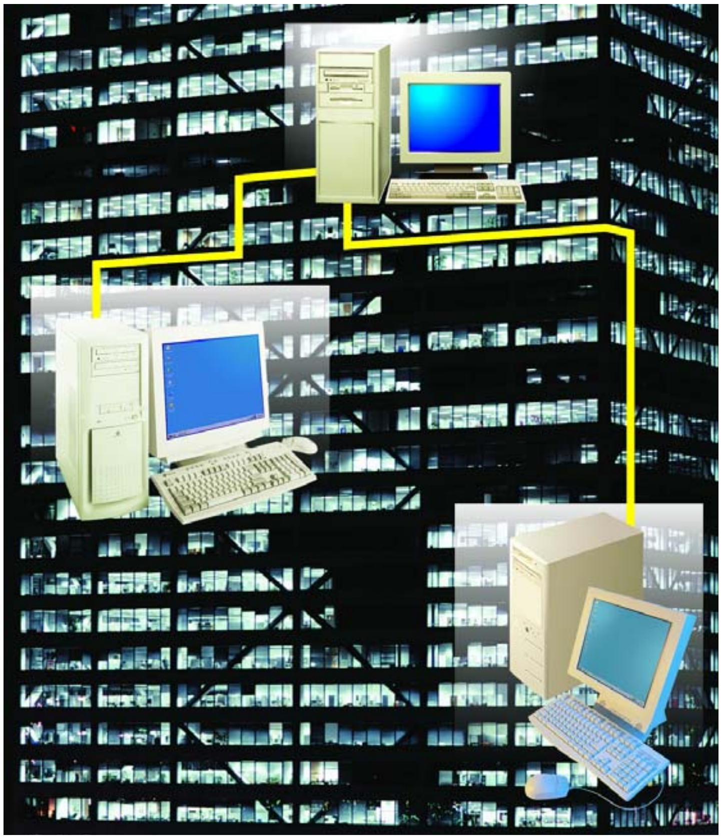


Figure 9-9 An example of a local area network (LAN).

OPERATING SYSTEMS THAT SUPPORT NETWORKS

Operating System	Requires Separate Operating System	Network Type
IBM OS/2 Warp		Client/Server
Linux		Client/Server
Microsoft Windows 95, Windows 98, and Windows Me		Peer-to-Peer
Microsoft Windows NT and Windows 2000		Client/Server
Novell NetWare	DOS	Client/Server
SpartaCom LANtastic	Any PC operating system	Peer-to-Peer
Sun Solaris™		Client/Server
UNIX		Client/Server

Figure 9-10 A list of popular operating systems that support networks. Many operating systems have network features built into them. In other cases, it is a set of programs that works with another operating system(s).

Web Link

For more information on a LAN, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click LAN.

have network features built into them. This figure also specifies the type of network the operating system supports, that is, peer-to-peer or client/server. The following paragraphs discuss peer-to-peer and client/server networks.

PEER-TO-PEER A **peer-to-peer** LAN is a simple, inexpensive network that typically connects less than 10 computers together. Each computer on a peer-to-peer network can share the hardware (such as a printer), data, or information located on any other computer in the network (Figure 9-11). Each computer stores files on its own storage devices. Thus, each computer in the network contains both the network operating system and application software. All computers on the network share any peripheral device attached to any computer. For example, one computer may have a laser printer and a scanner, while another has an ink-jet printer.

Peer-to-peer networks are ideal for very small businesses and home users. Some operating systems, such as Windows, include a peer-to-peer networking utility that allows you to set up a basic peer-to-peer network.

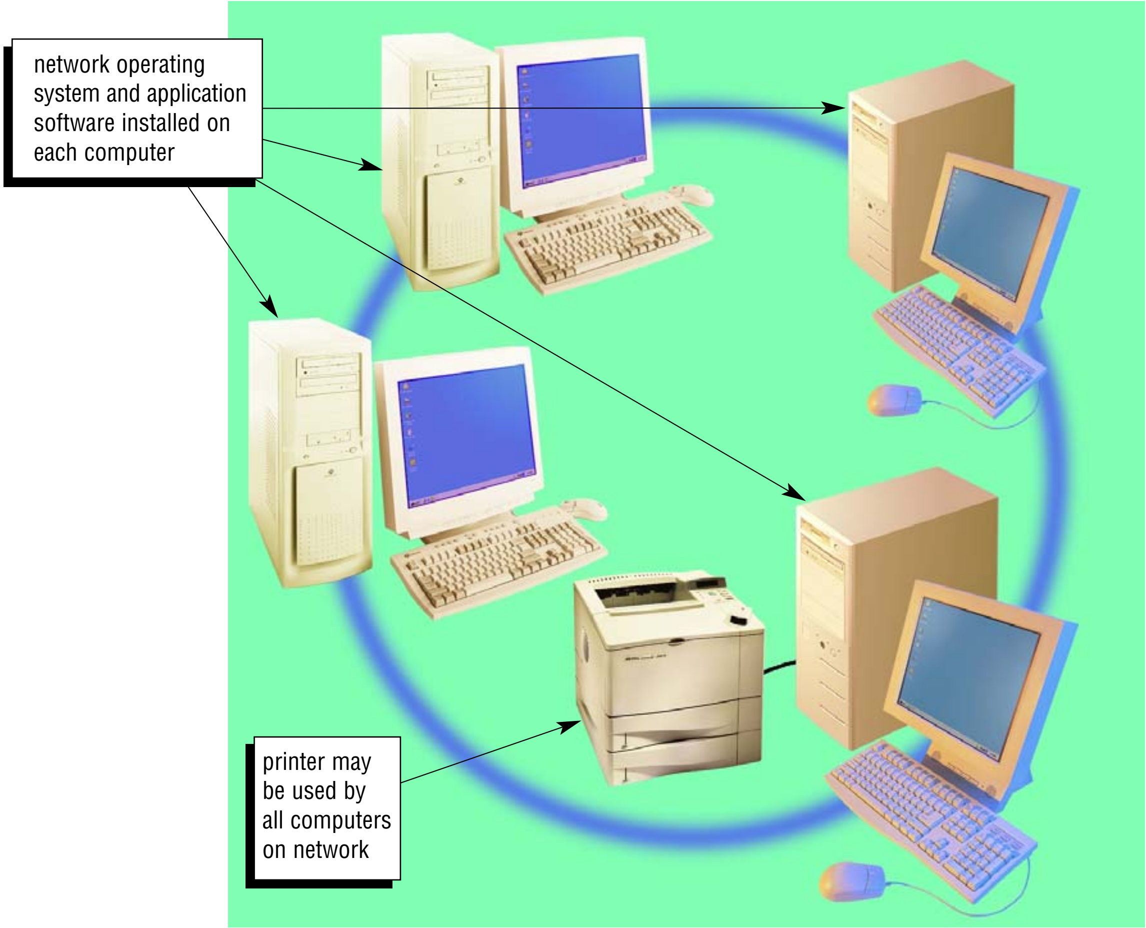

network operating system and application software installed on each computer
printer may be used by all computers on network

Figure 9-11 Each computer on a peer-to-peer network stores its own data and information.

CLIENT/SERVER A **client/server** LAN is a network in which one or more computers act as a server and the other computers on the network can request services from the server (Figure 9-12). A **server**, sometimes called the **host computer**, controls access to the hardware and software on the network and provides a centralized storage area for programs, data, and information. The other computers on the network, called **clients**, rely on the server for these resources. For example, a server might store a network version of a word processing program. Every client on the network can access the word processing program on the server.

The major difference between the server computer and the client computers is the server has more storage space and power. Some servers, called **dedicated servers**, perform a specific task. For example, a **file server** stores and manages files. A **print server** manages printers and print jobs. A **database server** stores and provides access to a database. A **network server** manages network traffic.

Although it can connect a smaller number of computers, a client/server network typically provides an efficient means to connect 10 or more computers together. Most client/server networks have a network administrator because of the larger size of a client/server network. The **network administrator** is the operations person in charge of the network.

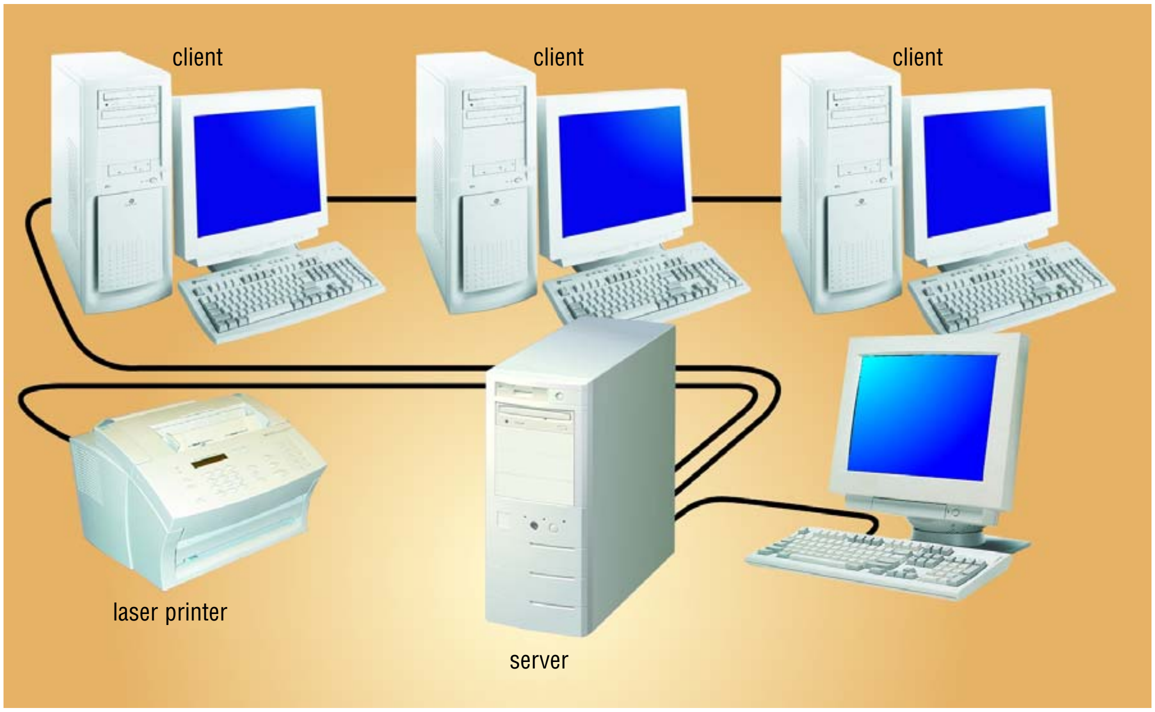


Figure 9-12 On a client/server network, one or more computers act as a server, and the other computers on the network are called clients.

COMPANY ON THE CUTTING EDGE

COMPAQ

Servers Are Heart of Technology Turnaround

When was the last time your boss lip-synched rock tunes at a company event and blasted electric-guitar songs from a boom box in the office? If you work at Compaq Computer Corporation, you would find Michael Capellas, the CEO, president, and board chairman, exhibiting this behavior daily.

Capellas' enthusiasm has helped reboot Compaq from a product-centered to a solution-oriented technology company. Its marketing campaign, *Inspiration Technology: The New IT*, reinforces Capellas' philosophy of being at the forefront of the digital revolution with network servers, storage systems, and wireless devices.

Compaq is one of the leading personal computer makers and the second-largest computer seller, with yearly revenues exceeding $38 million. The company's roots stem from the vision of three senior managers from Texas Instruments. In 1981, the three invested approximately $1,000 apiece and garnered a $2.5 million contribution from venture capitalist Ben Rosen.

Their initial success came from marketing IBM *clones*, look-alike computers that performed like IBMs, but were less costly. Compaq became the first company to achieve Fortune 500 status in less than four years. In 1988, the company acquired Digital Equipment Corporation, gaining that company's 25,000 field engineers and support staff.

For more information on Compaq, visit the Discovering Computers 2002 Companies Web page (**scsite.com/dc2002/companies.htm**) and click Compaq.

Wide Area Network (WAN)

A **wide area network (WAN)** is a network that covers a large geographic area (such as a city, country, or the world) using a communications channel that combines many types of media such as telephone lines, cables, and air waves (Figure 9-13). A WAN can be one large network or can consist of two or more LANs connected together. The Internet is the world's largest WAN.

Web Link

For more information on a wide area network, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click Wide Area Network.

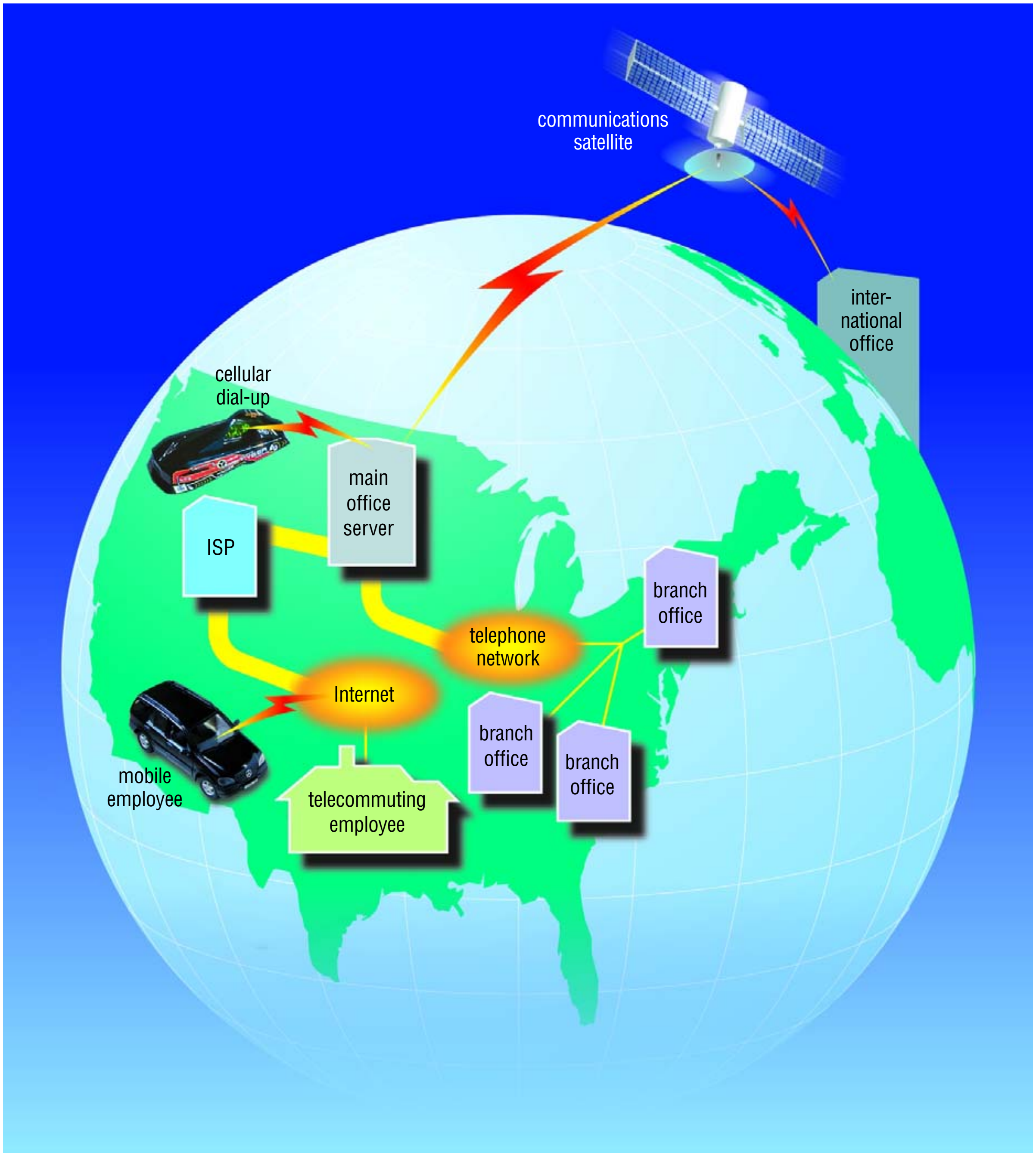


Figure 9-13 An example of a WAN.

INTERNET PEER-TO-PEER Another use of peer-to-peer, called **P2P**, describes an Internet network that enables users with the same networking software to connect to each other's hard disks and exchange files directly (Figure 9-14). With the appropriate software and an Internet connection, users can copy files from someone else's hard disk to their hard disk. As people connect to the network, you have access to their hard disk. When they log off, you no longer can access their hard disk. To maintain an acceptable speed for communications, most implementations of P2P limit the number of users.

Two examples of networking software that allow P2P are Napster and Gnutella. These programs have stirred much controversy with respect to copyright infringement of music because they allow users easily to copy MP3 music files from one computer to another. Many businesses, however, see an advantage to using P2P. That is, companies and employees can exchange files using P2P, freeing the company from maintaining a network for this purpose.

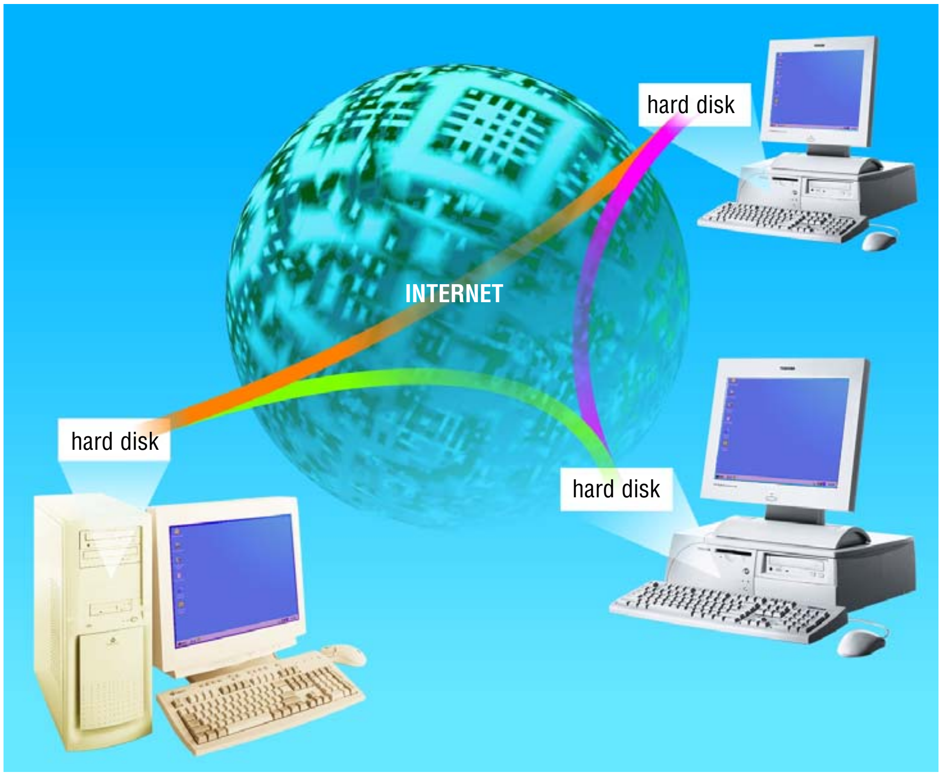


Figure 9-14 P2P describes an Internet network that enables users with the same networking software to connect to each other's hard disks and exchange files directly.

Metropolitan Area Network (MAN)

A **metropolitan area network** (**MAN**) is a backbone network that connects local area networks in a metropolitan area such as a city or town and handles the bulk of communications activity, or traffic, across that region. A MAN typically includes one or more LANs, but covers a smaller geographic area than a WAN. The state of Pennsylvania, for example, has a MAN that connects state agencies and individual users in the region around the state capital.

A MAN usually is managed by a consortium of users or by a single network provider who sells the service to the users. Local and state governments, for example, regulate some MANs. Telephone companies, cable television operators, and other organizations provide users with connections to the MAN.

Network Topologies

A **network topology** is the configuration, or physical arrangement, of the devices in a communications network. Three commonly used network topologies are bus, ring, and star. Networks usually use combinations of these topologies. The following pages discuss each of these topologies.

BUS NETWORK A **bus network** consists of a single central cable, to which all computers and other devices connect (Figure 9-15). The **bus**, also called the **backbone**, is the physical cable that connects the computers and other devices. The bus in a bus network can transmit data, instructions, and information in both directions. When a sending device transmits data, the address of the receiving device is included with the transmission so the data is routed to the appropriate receiving device.

Bus networks are very popular in LANs because they are inexpensive and easy to install. One advantage of the bus network is you can attach and detach computers and other devices at any point on the bus without disturbing the rest of the network. Another advantage is failure of one device usually does not affect the rest of the bus network. The transmission simply bypasses the failed device. The greatest risk to a bus network is that the bus itself might become inoperable. If that happens, the network remains inoperative until the bus is back in working order.

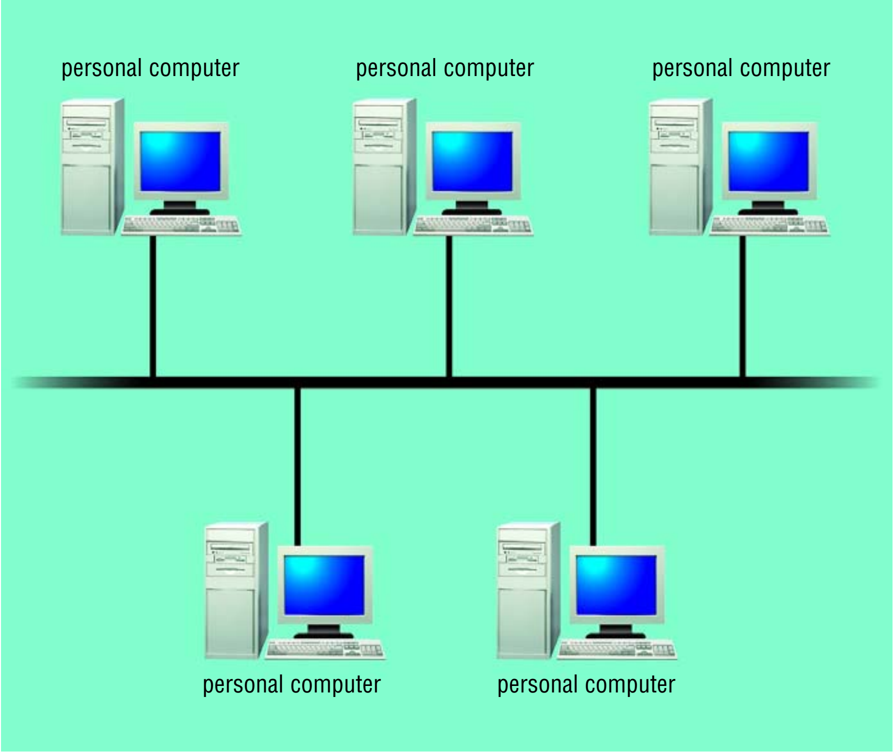


Figure 9-15 Devices in a bus network share a single data path.

RING NETWORK In a **ring network**, a cable forms a closed ring, or loop, with all computers and devices arranged along the ring (Figure 9-16). Data transmitted on a ring network travels from device to device around the entire ring, in one direction. When a computer sends data, the data travels to each computer on the ring until it reaches its destination.

If a device on a ring network fails, all devices before the failed device are unaffected, but those after the failed device cannot function. A ring network can span a larger distance than a bus network, but it is more difficult to install.

The ring topology primarily is used for LANs, but also is used to connect a mainframe to a WAN.

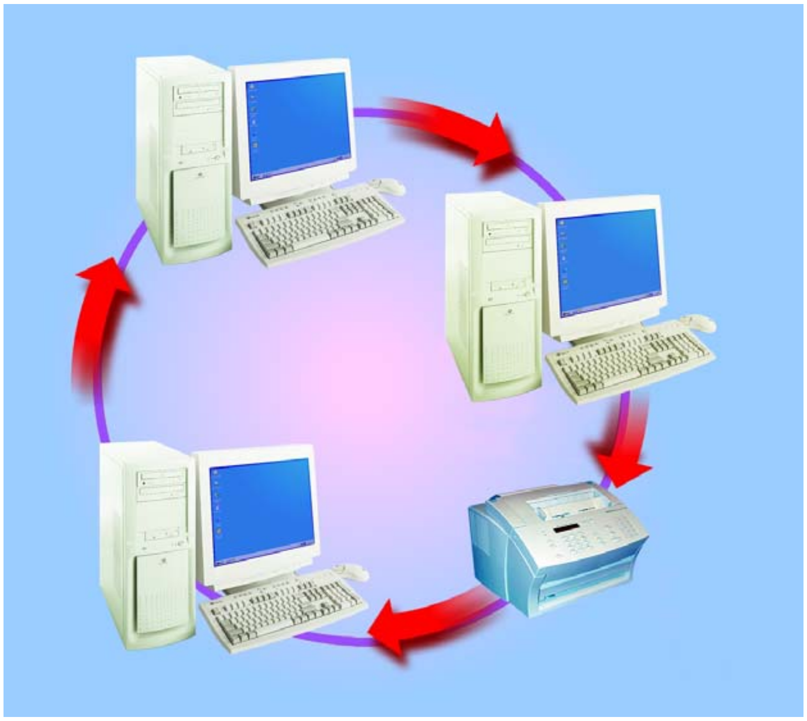


Figure 9-16 In a ring network, all connected devices form a continuous loop.

STAR NETWORK In a **star network**, all of the devices in the network connect to a central computer, thus forming a star (Figure 9-17). The central computer that provides a common connection point for devices in the network is called the **hub**. All data that transfers from one computer to another passes through the hub.

Similar to a bus network, star networks are fairly easy to install and maintain. You can add and remove computers and devices to and from the network with little or no disruption to the network.

In a star network, if one device fails, only that device is affected. The other devices continue to operate normally. If the hub fails, however, the entire network is inoperable until the hub is repaired. Most large star networks, therefore, keep backup hubs available in case the primary hub fails.

Web Link
For more information on Ethernet, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click Ethernet.

Network Communications Technologies

Today's networks connect terminals, devices, and computers from many different manufacturers across many types of networks, such as wide area, local area, and wireless. For the different devices on several types of networks to be able to communicate, the network must use a specific combination of hardware and software. A variety of communications technologies exist for this purpose, as described in the following paragraphs.

ETHERNET **Ethernet** is a LAN technology that allows personal computers to contend for access to the network. If two computers on an Ethernet network attempt to send data at the same time, a collision occurs, and the computers must attempt to send their messages again.

Ethernet is based on a bus topology, but Ethernet networks can

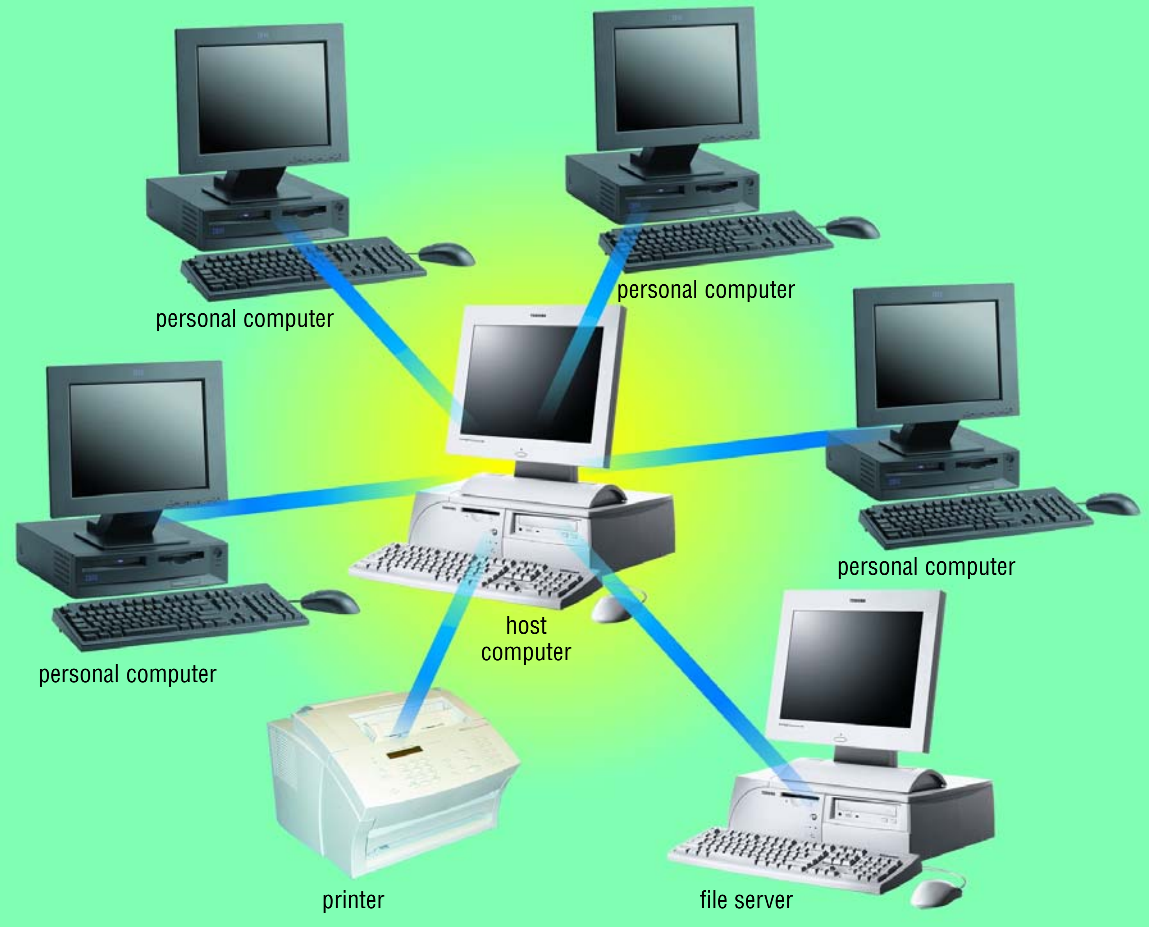


Figure 9-17 A star network contains a single, centralized host computer in which all the devices in the network communicate.

be wired in a star pattern. Today, Ethernet is the most popular LAN because it is relatively inexpensive and easy to install and maintain.

Ethernet networks often use cables to transmit data. The original Ethernet standard is not very fast by today's standards. For small to medium networks, however, Ethernet works quite well. A more recent Ethernet standard, called **Fast Ethernet**, transmits data and information at speeds up to 10 times faster than the original standard. **Gigabit Ethernet** provides an even higher speed of transmission, with speeds up to 10 times faster than Fast Ethernet.

TOKEN RING **Token ring**, another LAN technology, controls access to the network by requiring that network devices share or pass a special signal, called a token. A token is similar to a ticket. The device with the token can transmit data over the network. Only one token exists per network. This ensures that only one computer can transmit data at a time. Token ring is based on a ring topology (although it can use a star topology).

TCP/IP Short for **transmission control protocol/Internet protocol**, **TCP/IP** is a technology that manages the transmission of data by breaking it up into packets. Internet transmissions commonly use TCP/IP. When a computer sends data over the Internet, the data is divided into small pieces, or **packets**. Each packet contains the data, as well as the recipient (destination), origin (sender), and the sequence information used to reassemble the data at the destination. These packets travel along the fastest available path to the recipient's computer via devices called **routers**.

TECHNOLOGY TRAILBLAZER

ROBERT **METCALFE**

Communications is essential in today's digital world, and Robert Metcalfe is doing his part to enhance communications skills.

As the inventor of Ethernet, Metcalfe set the technology that allows personal computers to communicate across networks. As founder of California-based 3Com Corporation, he realizes the need for employees, especially engineers, to communicate their ideas clearly when they speak and write. To further this notion, he has funded a program at his alma mater, Massachusetts Institute of Technology, to support the faculty who teach writing to undergraduates. As a former publisher and a current *Infoworld* magazine columnist, he communicates in-depth technical analysis to hundreds of thousands of information technology professionals.

From age 10, Metcalfe wanted to be an electrical engineer. Graduating from MIT in 1969, he pursued a master's degree in applied mathematics and a Ph.D. in computer science at Harvard. While working on his dissertation at Xerox's Palo Alto Research Center, Metcalfe conducted research on packet switching for the ARPANET and AlohaNet computer networks. He started 3Com Corporation in 1979 to promote Ethernet.

For more information on Robert Metcalfe, visit the Discovering Computers 2002 People Web page (**scsite.com/dc2002/people.htm**) and click Robert Metcalfe.

COMPANY ON THE CUTTING EDGE

Sun microsystems

Networking First, Last, and Always

Despite the fact that one-half of the people on Earth never have made a telephone call, Sun Microsystems CEO and President Scott McNealy predicts every man, woman, and child always will be connected to a network. Chances are these people will be using technology developed by Sun.

McNealy and three friends started their company in 1982 with the goal of building engineering workstations in the network computer model. They were working closely with the Stanford University Network (SUN), which accounts for the name of their company. Their first workstation included TCP/IP, the Internet communications technology.

Networking increases employees' overall productivity, according to McNealy. His philosophy certainly holds true for his own company. By 1988, Sun had reached $1 billion in revenues, making it the fastest-growing company in history. Four years later, it had become the world's second most profitable company. Today, Sun has a presence in more than 170 countries and boasts $15.7 billion in annual revenues. Building industrial-strength hardware, software, and services around its vision, *The Network is the Computer*, Sun's technology powers the Internet and allows companies worldwide to become involved in e-commerce.

For more information on Sun Microsystems, visit the Discovering Computers 2002 Companies Web page (**scsite.com/dc2002/companies.htm**) and click Sun Microsystems.

This technique of breaking a message into individual packets, sending the packets along the best route available, and then reassembling the data is called **packet switching**.

WAP The **Wireless Application Protocol** (**WAP**) allows wireless mobile devices to access the Internet and its services such as the Web and e-mail. WAP uses a client/server network. The wireless device contains the client software, which connects to the Internet service provider's server. Devices that support WAP, called **WAP-enabled devices**, include Web-enabled telephones, pagers, and handheld computers. As the demand for wireless Internet access grows, the availability of WAP-enabled devices will increase.

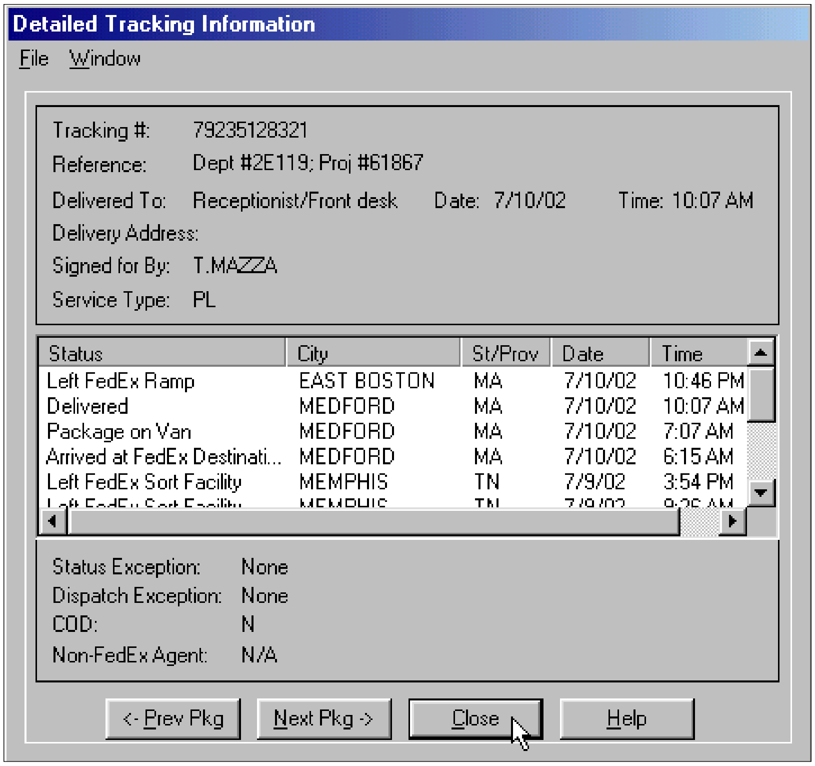
Intranets

Recognizing the efficiency and power of the Internet, many organizations apply Internet and Web technologies to their own internal networks. An **intranet** (intra means inside) is an internal network that uses Internet technologies. Intranets generally make company information accessible to employees and facilitate working in groups. Simple intranet applications include electronic publishing of organizational materials such as telephone directories, event calendars, procedure manuals, employee benefits information, and job postings. An intranet typically also includes a connection to the Internet. More sophisticated uses of intranets include groupware applications such as project management, chat rooms, newsgroups, group scheduling, and videoconferencing.

An intranet essentially is a small version of the Internet that exists within an organization. It uses TCP/IP technologies, has a Web server, supports multimedia Web pages coded in HTML, and is accessible via a Web browser such as Microsoft Internet Explorer or Netscape Navigator. Users can post and update information on the intranet by creating and posting a Web page, using a method similar to that used on the Internet.

Sometimes a company uses an **extranet**, which allows customers or suppliers to access part of its intranet. Federal Express, for example, allows customers to access their intranet to print air bills, schedule pickups, and even track shipped packages as they travel to their destination (Figure 9-18).

FIREWALLS As a public network, anyone with the proper connection can access the Internet. A private corporate intranet or extranet, by contrast, restricts access to specific authorized users, usually employees, suppliers, vendors, and customers. To prevent unauthorized access to data and information, companies protect their intranet or extranet with a firewall. A **firewall** is a general term that refers to hardware and/or software that restricts access to data and information on a network (Figure 9-19). One use of firewalls is to deny network access to outsiders. Chapter 12 discusses firewalls in more depth.



Tracking #: 79235128321
Reference: Dept #2E119; Proj #61867
Delivered To: Receptionist/Front desk Date: 7/10/02 Time: 10:07 AM
Delivery Address:
Signed for By: T.MAZZA
Service Type: PL

Status	City	St/Prov	Date	Time
Left FedEx Ramp	EAST BOSTON	MA	7/10/02	10:46 PM
Delivered	MEDFORD	MA	7/10/02	10:07 AM
Package on Van	MEDFORD	MA	7/10/02	7:07 AM
Arrived at FedEx Destinati...	MEDFORD	MA	7/10/02	6:15 AM
Left FedEx Sort Facility	MEMPHIS	TN	7/9/02	3:54 PM

Status Exception: None
Dispatch Exception: None
COD: N
Non-FedEx Agent: N/A

Figure 9-18 Federal Express uses an extranet to allow customers to ship and track packages. As shown in this figure, customers can track the progress of shipped packages as the packages travel to their destination.

Web Link

For more information on TCP/IP, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click TCP/IP.

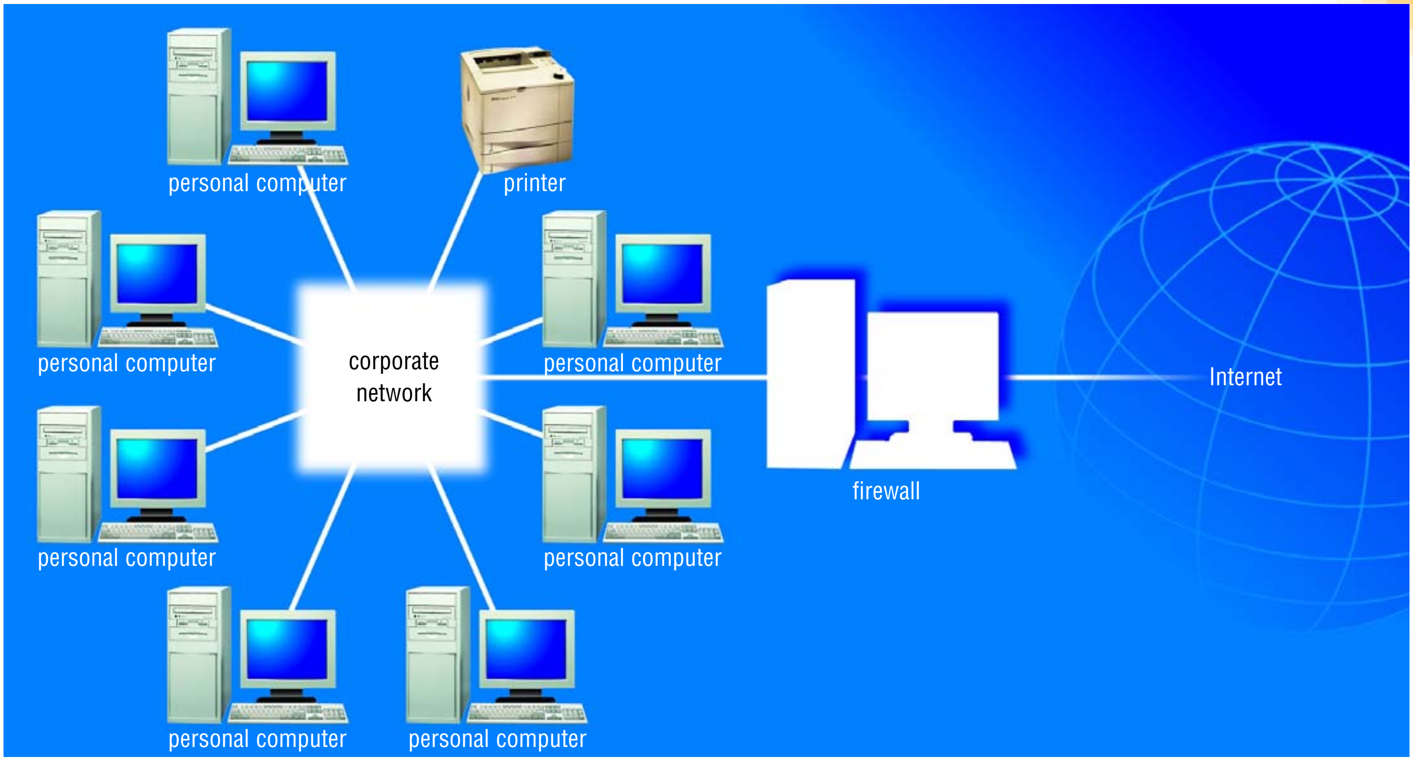


Figure 9-19 One use of a firewall is to restrict outsiders from accessing data and information on a network.

ISSUE

Spending Tax Money

Intranets

Some Florida law enforcement agencies have adopted an intranet to help solve crime. The internal network lets various bureaus access crime reports, rap sheets, mug shots, fingerprints, and other crime-related data stored by different agencies. Investigators can collect information in minutes that once might have taken days to gather. In addition, sophisticated search algorithms can pinpoint connections that may not have been recognized by human detectives. The intranet cost $1.5 million to establish, and future intranets will cost $300,000. Despite the intranet's success, some complain the money would be better spent putting more officers on the street. Do you think the intranet is worth the cost? Why or why not? If it were your tax dollars, how would you prefer to have the money spent? Why?

For more information on technology and law enforcement, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 9 Issue #4.

Home Networks

If you have multiple computers in your home or home office, you can connect all of them together with a **home network** (Figure 9-20). The advantages of a home network are many. All computers in the house can be connected to the Internet at the same time. Each computer can access files and programs on the other computers in the home. All computers can share peripherals such as a scanner, printer, or a DVD drive.

Four types of home networks exist: Ethernet network, HomePLC network, Phoneline network, and HomeRF network.

- As discussed earlier in this chapter, an Ethernet network requires you to connect a cable to each computer. This may involve running cable through walls, ceilings, and floors. For the average home user, the hardware and software of an Ethernet network can be difficult to configure.
- A **HomePLC (powerline cable) network**, sometimes called a **powerline LAN**, is a network that uses the same lines that bring electricity and power into your home. This network requires no additional wiring. You plug one end of a cable into the computer's parallel port and the other into a wall outlet. The data transmits through the existing power lines in the house.
- A **phoneline network** is an easy-to-install and inexpensive network that uses existing telephone lines in the home. With this network, you connect one end of a cable in the computer and the other end into a telephone jack. The phoneline network does not interfere with voice and data transmissions on the telephone lines. That is, you can talk on the telephone and use the same line to connect to the Internet.
- A **HomeRF (radio frequency) network** uses radio waves, instead of cables, to transmit data. A HomeRF network sends signals through the air. You connect one end of a cable to the special card in the computer and the other end to a transmitter/receiver that has an antenna to pick up signals.

Web Link

For more information on home networks, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click Home Networks.

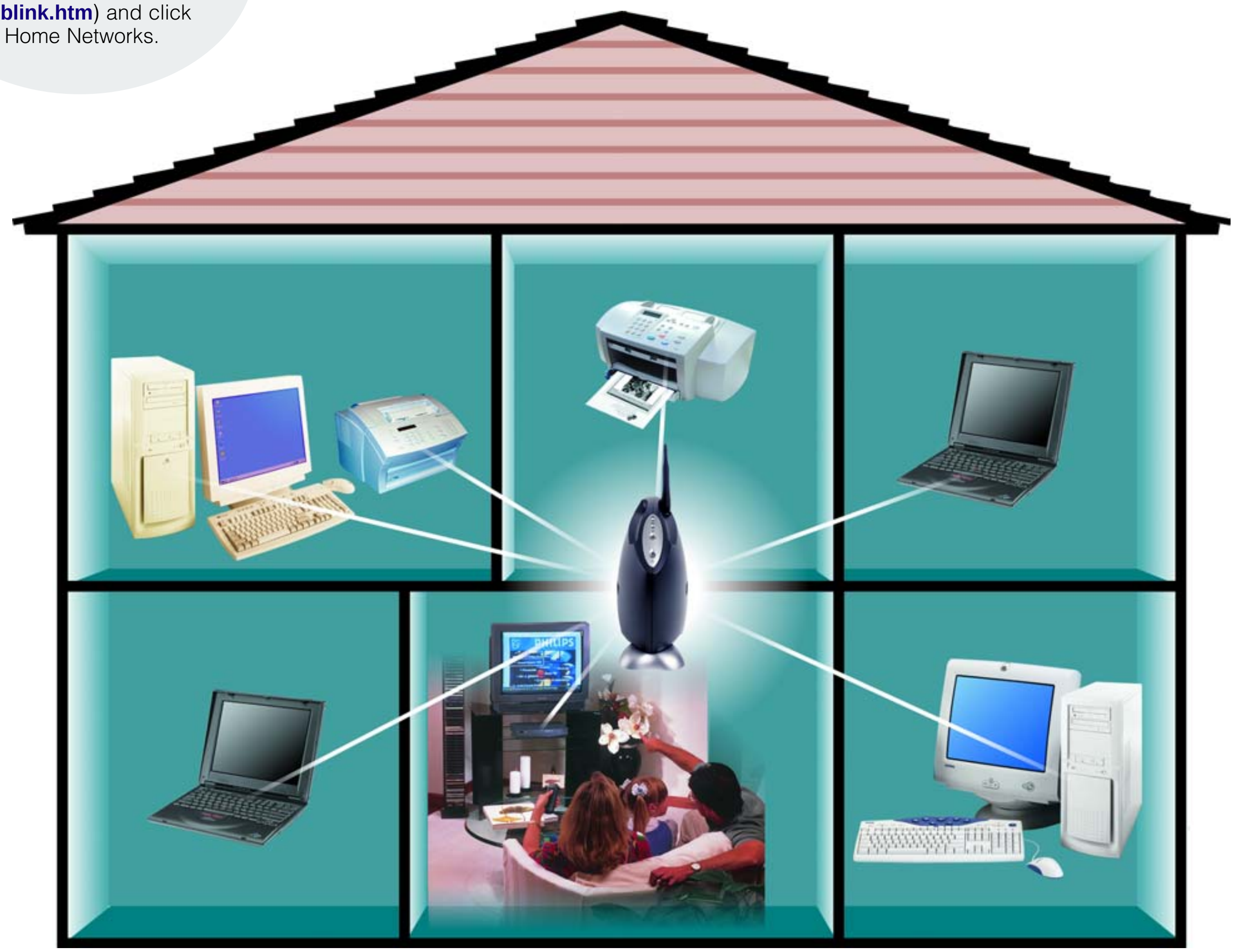


Figure 9-20 An example of a home network.

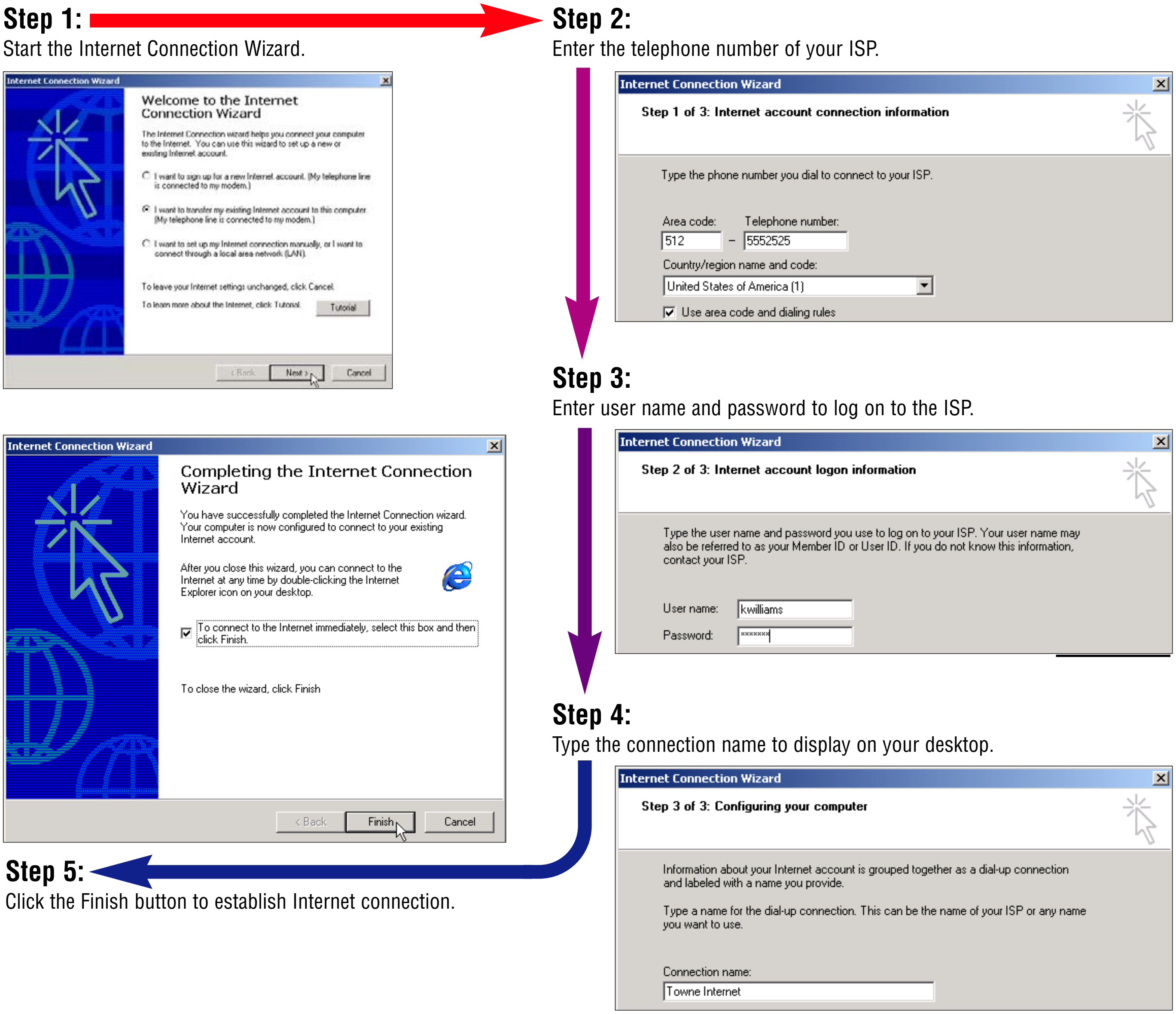
Many vendors offer home networking packages that include all the necessary hardware and software to network your home using these techniques. Some also offer intelligent networking capabilities. An **intelligent home network** also extends the basic home network to include features such as lighting control, thermostat adjustment, and a security system.

COMMUNICATIONS SOFTWARE

Some communications devices are preprogrammed to accomplish communications tasks. Other communications devices require a separate communications software program to ensure proper transmission of data. **Communications software** consists of programs that help you establish a connection to another computer or network, and manage the transmission of data, instructions, and information. For two computers to communicate, they must have compatible communications software.

Often, separate communications programs on your computer each serve a different purpose. One type of communications software helps you establish a connection to another computer on the Internet using wizards, dialog boxes, and other on-screen messages (Figure 9-21).

Figure 9-21 HOW THE INTERNET CONNECTION WIZARD WORKS



Step 1:
Start the Internet Connection Wizard.

Internet Connection Wizard

Welcome to the Internet Connection Wizard

The Internet Connection wizard helps you connect your computer to the Internet. You can use this wizard to set up a new or existing Internet account.

○ I want to sign up for a new Internet account. (My telephone line is connected to my modem.)

● I want to transfer my existing Internet account to this computer. (My telephone line is connected to my modem.)

○ I want to set up my Internet connection manually, or I want to connect through a local area network (LAN).

To leave your Internet settings unchanged, click Cancel.

To learn more about the Internet, click Tutorial.

Step 2:
Enter the telephone number of your ISP.

Internet Connection Wizard

Step 1 of 3: Internet account connection information

Type the phone number you dial to connect to your ISP.

Area code: 512 – Telephone number: 5552525

Country/region name and code: United States of America (1)

☑ Use area code and dialing rules

Step 3:
Enter user name and password to log on to the ISP.

Internet Connection Wizard

Step 2 of 3: Internet account logon information

Type the user name and password you use to log on to your ISP. Your user name may also be referred to as your Member ID or User ID. If you do not know this information, contact your ISP.

User name: kwilliams

Password: *******

Step 4:
Type the connection name to display on your desktop.

Internet Connection Wizard

Step 3 of 3: Configuring your computer

Information about your Internet account is grouped together as a dial-up connection and labeled with a name you provide.

Type a name for the dial-up connection. This can be the name of your ISP or any name you want to use.

Connection name: Towne Internet

Step 5:
Click the Finish button to establish Internet connection.

Internet Connection Wizard

Completing the Internet Connection Wizard

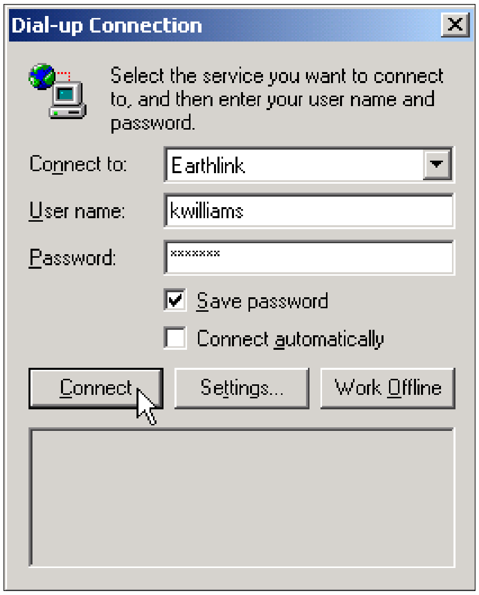
You have successfully completed the Internet Connection wizard. Your computer is now configured to connect to your existing Internet account.

After you close this wizard, you can connect to the Internet at any time by double-clicking the Internet Explorer icon on your desktop.

☑ To connect to the Internet immediately, select this box and then click Finish.

To close the wizard, click Finish.

Once the Internet connection is established, communications software provides a means to access the Internet using an ISP (Figure 9-22).



Select the service you want to connect to, and then enter your user name and password.

Connect to: Earthlink
User name: kwilliams
Password: *******
☑ Save password
☐ Connect automatically

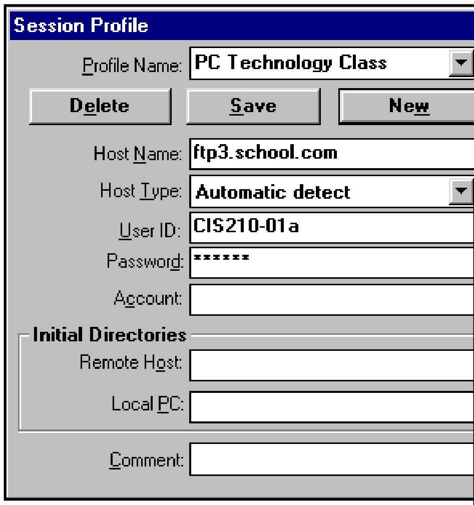
Figure 9-22 Through this dialog box, you can access the Internet using the Earthlink ISP.

Some communications software programs support file transfer protocol. **FTP** (**file transfer protocol**) is an Internet standard that allows you to upload and download files to and from a Web server, called the **FTP server**. To view or use a file on an FTP server, you can download the file from the server to your computer, or you can use an FTP program to access the file directly on the FTP server. Many FTP sites are public, called **anonymous FTP**, and allow anyone to transfer files using their FTP program. For these sites, you enter the word, anonymous, if prompted for a password. Other sites require a specific user name and password to access the FTP server.

Often, files on an FTP server are compressed to reduce their transfer time. As discussed in Chapter 8, you must decompress a compressed file before viewing it.

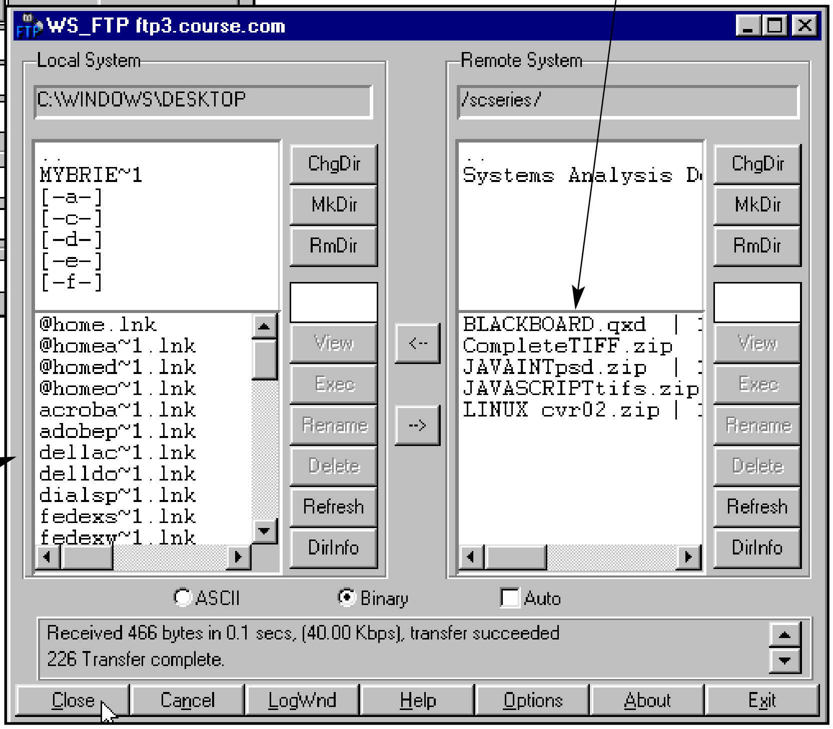
Sometimes, you want to upload files to an FTP server. For example, if you create a personal Web page, you will want to copy it from your computer to the Web server. To do this, you can use an FTP program (Figure 9-23). Many ISPs and OSPs provide an FTP program as part of their Internet access service. You also can download public-domain FTP programs from the Web.

Figure 9-23a (FTP logon information)



Profile Name: PC Technology Class
Host Name: ftp3.school.com
Host Type: Automatic detect
User ID: CIS210-01a
Password: ******
Account:
Initial Directories
Remote Host:
Local PC:
Comment:

files on FTP server



Local System: C:\WINDOWS\DESKTOP

```
..
MYBRIE~1
[-a-]
[-c-]
[-d-]
[-e-]
[-f-]
@home.lnk
@homea~1.lnk
@homed~1.lnk
@homeo~1.lnk
acroba~1.lnk
adobep~1.lnk
dellac~1.lnk
delldo~1.lnk
dialsp~1.lnk
fedexs~1.lnk
fedexw~1.lnk
```

Remote System: /scseries/

```
..
Systems Analysis D
BLACKBOARD.qxd  |
CompleteTIFF.zip
JAVAINTpsd.zip  |
JAVASCRIPTtifs.zip
LINUX cvr02.zip |
```

○ ASCII ● Binary ☐ Auto

```
Received 466 bytes in 0.1 secs, (40.00 Kbps), transfer succeeded
226 Transfer complete.
```

files on your computer

Figure 9-23b (connection established to FTP server)

Figure 9-23 An FTP program allows you to upload and download files to and from an FTP server.

Web Link

For more information on FTP programs, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click FTP Programs.

THE TELEPHONE NETWORK

The **public switched telephone network** (**PSTN**) is the worldwide telephone system that handles voice-oriented telephone calls (Figure 9-24). Nearly the entire telephone network today uses digital technology, with the exception of the final link from the local telephone company to a home, which usually is analog.

While initially it was built to handle voice communications, the telephone network also is an integral part of computer communications. Data, instructions, and information can be sent over the telephone network using dial-up lines or dedicated lines. The following sections discuss each of these types of connections.

Dial-Up Lines

A **dial-up line** is a temporary connection that uses one or more analog telephone lines for communications. A dial-up connection is not permanent. Using a dial-up line to transmit data is similar to using the telephone to make a call. A modem at the sending end dials the telephone number of a modem at the receiving end. When the modem at the receiving end answers the call, a connection is established and data can be transmitted. When either modem hangs up, the communications end.

One advantage of a dial-up line to connect computers is that it costs no more than making a regular telephone call. Another advantage is that computers at any two locations can establish a connection using modems and the telephone network. Mobile users, for example, often use dial-up lines to connect to their main office network so they can read e-mail messages, access the Internet, and upload files.

A disadvantage of dial-up lines is that you cannot control the quality of the connection because the telephone company's switching office randomly selects the line.

Dedicated Lines

A **dedicated line** is a connection that always is established between two communications devices (unlike a dial-up line where the connection is reestablished each time it is used). The quality and consistency of the connection on a dedicated line is better than a dial-up line because dedicated lines provide a constant connection.

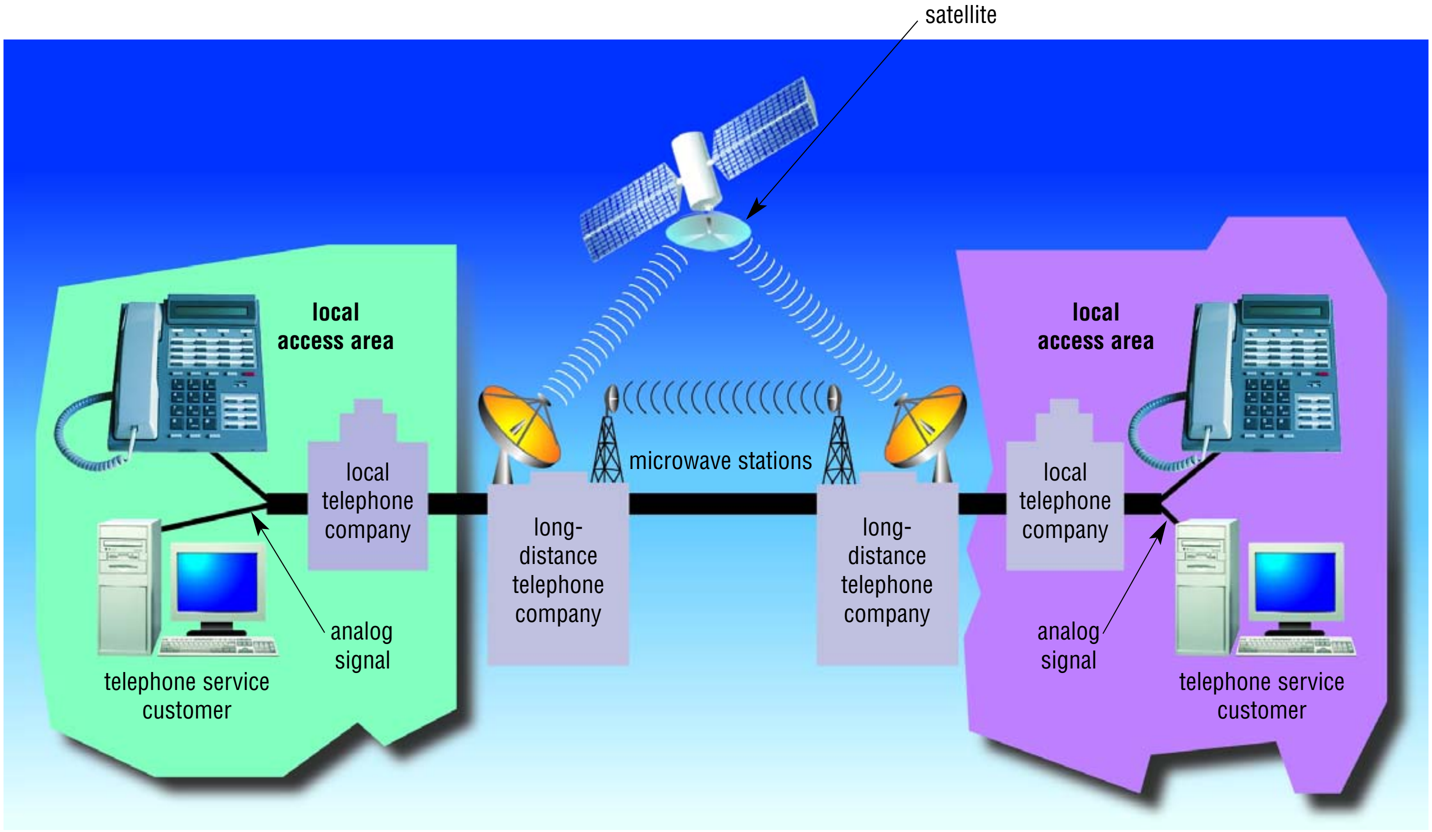


Figure 9-24 Nearly all of the telephone network uses digital technology, with the exception of the final link from the local telephone company to a home or office, which usually is analog.

Businesses often use dedicated lines to connect geographically distant offices. Dedicated lines either can be analog or digital. Digital lines increasingly are connecting home and business users to networks around the globe because they transmit data and information at faster rates than analog lines.

A **transfer rate** is the speed with which a line carries data and information. The faster the transfer rate, the faster you can send and receive data and information. Transfer rates usually are expressed as **bits per second** (**bps**) — that is, the number of bits the line can transmit in one second. Transfer rates range from thousands of bits per second, called **kilobits per second** (**Kbps**), to millions of bits per second, called **megabits per second** (**Mbps**), to billions of bits per second, called **gigabits per second** (**Gbps**). The table in Figure 9-25 lists the transfer rates (speeds) and approximate monthly costs of various types of lines, as compared with dial-up lines.

Four popular types of digital dedicated lines are ISDN lines, digital subscriber lines, T-carrier lines, and ATM.

ISDN Lines

For the small business and home user, an ISDN line provides faster transfer rates than dial-up telephone lines. **ISDN** (**Integrated Services Digital Network**) is a set of standards for digital transmission of data over standard copper telephone lines. With ISDN, the same telephone line that could carry only one computer signal, now can carry three or more signals at once, through the same line, using a technique called **multiplexing**.

ISDN requires that both ends of the connection have an ISDN modem. This type of modem is different from the type used in dial-up connections. ISDN lines also require a special ISDN telephone for voice communications. Home and business users who choose ISDN lines benefit from faster Web page downloads and clearer videoconferencing. ISDN connections also produce voice conversations that are very clear.

DSL

DSL is another digital line alternative for the small business or home user. **DSL** (**digital subscriber line**) transmits at fast speeds on existing standard copper telephone wiring. Some of the DSL installations can provide a dial tone, so you can use the line for both voice and data.

To connect to DSL, a customer must have a special network card or DSL modem. Similar to ISDN modems, a DSL modem is different from the modem used for dial-up connections. Some experts predict that DSL eventually will replace ISDN because it is much easier to install and can provide much faster data transfer rates.

ADSL is one of the more popular types of DSLs. As shown in Figure 9-26, **ADSL** (**asymmetric digital subscriber line**) is a type of DSL that supports faster transfer rates when receiving data (the downstream rate) than when sending data (the upstream rate). ADSL is ideal for Internet access because most users download more information from the Internet than they upload.

Cable Television Lines

Although cable television (CATV) lines are not a type of telephone line, they are a very popular type of dedicated line that allows the home user to connect to the Internet. A later section discusses the use of CATV to connect to the Internet.

SPEEDS OF VARIOUS CONNECTIONS TO THE INTERNET

Type of Line	Transfer Rates	Approximate Monthly Cost
Dial-up	Up to 56 Kbps	Local or Long-Distance Rates
ISDN (BRI)	Up to 128 Kbps	$10 to $40
ADSL	128 Kbps – 8.45 Mbps	$39 to $110
Cable TV (CATV)	128 Kbps – 2.5 Mbps	$30 to $70
T1	1.544 Mbps	$1,000 or more
T3	44 Mbps	$10,000 or more
ATM	155 to 622 Mbps	$8,000 or more

Figure 9-25 The speeds of various lines that can be used to connect to the Internet.

Web Link

For more information on DSL, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click DSL.

T-carrier Lines

A **T-carrier line** is any of several types of digital lines that carry multiple signals over a single communications line. Whereas a standard dial-up telephone line carries only one signal, digital T-carrier lines use a technique called multiplexing so that multiple signals can share the telephone line. T-carrier lines provide extremely fast data transfer rates. Only medium to large companies usually can afford the investment in T-carrier lines because these lines also are so expensive.

The most popular T-carrier line is the **T1 line**. Businesses often use T1 lines to connect to the Internet. Many service providers also use T1 lines to connect to the Internet backbone. A **T3 line** is equal in speed to 28 T1 lines. T3 lines are quite expensive. Main users of T3 lines include large companies, telephone companies, and service providers connecting to the Internet backbone. The Internet backbone itself also uses T3 lines.

Asynchronous Transfer Mode

Asynchronous transfer mode (**ATM**) is a service that carries voice, data, video, and multimedia at extremely high speeds. Telephone networks, the Internet, and other networks with large amounts of traffic use ATM. Some experts predict that ATM eventually will become the Internet standard for data transmission, replacing T3 lines.

COMMUNICATIONS DEVICES

A **communications device** is any type of hardware capable of transmitting data, instructions, and information between a sending device and a receiving device. At the sending end, a communications device sends the data, instructions, or information from the sending device to a communications channel. At the receiving end, the communications device receives the signals from the communications channel. Sometimes, the communications device also must convert the data, instructions, and information from analog to digital signals or vice versa, depending on the devices and media involved.

Some of the more common types of communications devices are dial-up modems, ISDN and DSL modems, cable modems, and network interface cards. The following pages describe these devices.

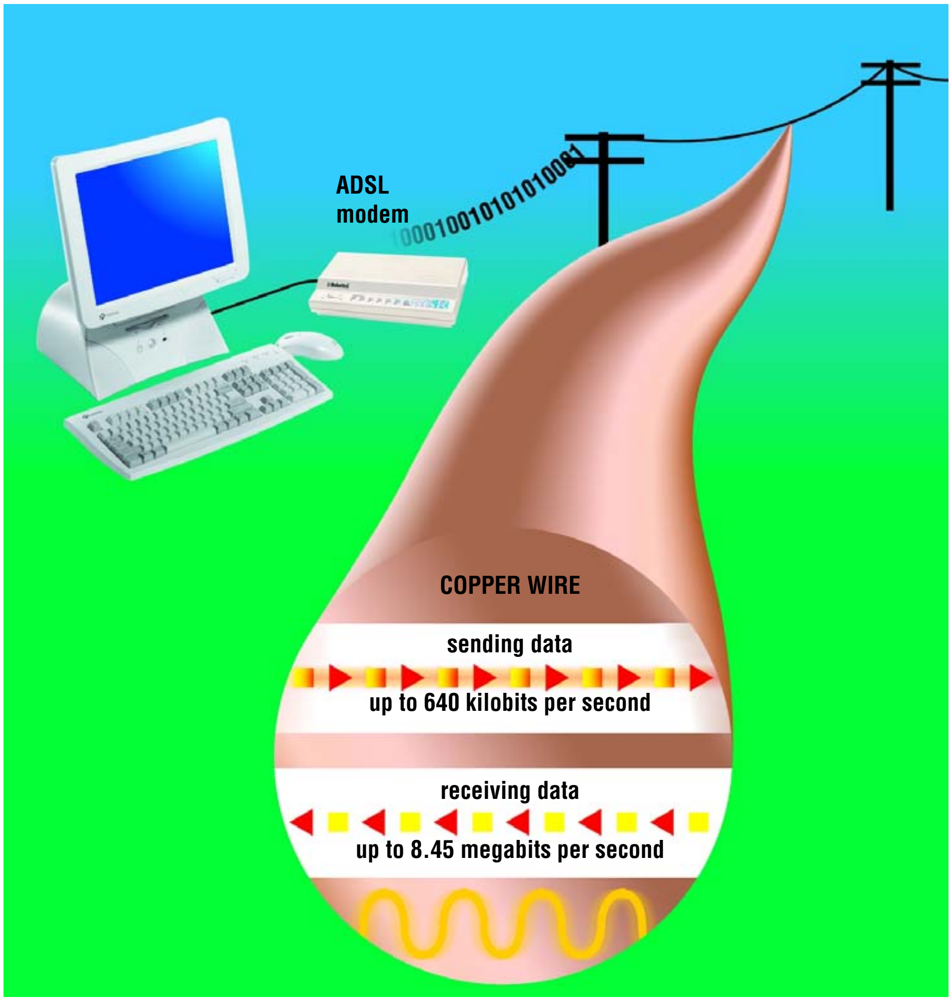

ADSL
modem
COPPER WIRE
sending data
up to 640 kilobits per second
receiving data
up to 8.45 megabits per second

Figure 9-26 ADSL connections transmit data downstream at a much faster rate than upstream.

Modems

As previously discussed, a computer's digital signals must be converted to analog signals before they are transmitted over standard telephone lines. The communications device that performs this conversion is a **modem**, sometimes called a **dial-up modem**. The word, modem, is derived from a combination of the words, **modulate**, to change into an analog signal and, **demodulate**, to convert an analog signal into a digital signal. Both the sending and receiving ends of a communications channel must have a modem for data transmission to occur.

Web Link

For more information on modems, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click Modems.

Web Link

For more information on cable modems, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click Cable Modems.

A modem can be an external or an internal device (Figure 9-27). An **external modem** is a stand-alone (separate) device that attaches to a special serial port, such as RS-232, on a computer with a standard telephone cord connected to a telephone outlet. You easily can move an external modem from one computer to another.

An **internal modem** is a card that you insert into an expansion slot on a computer's motherboard. One end of a standard telephone cord attaches to a port on the modem and the other end plugs into a telephone outlet. Devices other than computers use internal modems. A stand-alone fax machine, for example, has an internal modem that converts a scanned digitized image into an analog signal that can be sent to the recipient's fax machine. One advantage of internal modems over external modems is that they do not require desk space.

As discussed in Chapter 4, notebook and other mobile computers can use a modem in the form of a PC Card that you insert into a PC Card slot on the computer. The PC Card modem attaches to a telephone outlet with a standard telephone cord. Mobile users without access to a telephone outlet also can use a special cable to attach the PC Card modem to a cellular telephone, thus enabling them to transmit data over a cellular telephone. Some mobile users have a **wireless modem** that allows access to the Web wirelessly from notebook and handheld computers, cellular telephones, and other mobile devices. These wireless modems typically use the same waves used by cellular telephones.

ISDN and DSL Modems

If you access the Internet using ISDN or DSL, you need a communications device to send and receive the digital ISDN or DSL signals. A modem used for dial-up access will not work because it converts analog signals to digital signals and vice versa. In the case of ISDN and DSL, this conversion is not necessary. Both the computer and the ISDN or DSL already use digital signals.

A **digital modem** is one that sends and receives data and information to and from a digital telephone line such as ISDN or DSL. According to the definition of a modem (to convert from analog to digital signals and vice versa), the use of the term modem in this context is not correct. Industry manufacturers, however, still refer to ISDN and DSL modems as digital modems.

An **ISDN modem**, also called an **ISDN adapter**, sends digital data and information from your computer to an ISDN line and receives digital data and information from an ISDN line. A **DSL modem** sends digital data and information from your computer to a DSL line and receives digital data and information from a DSL line.

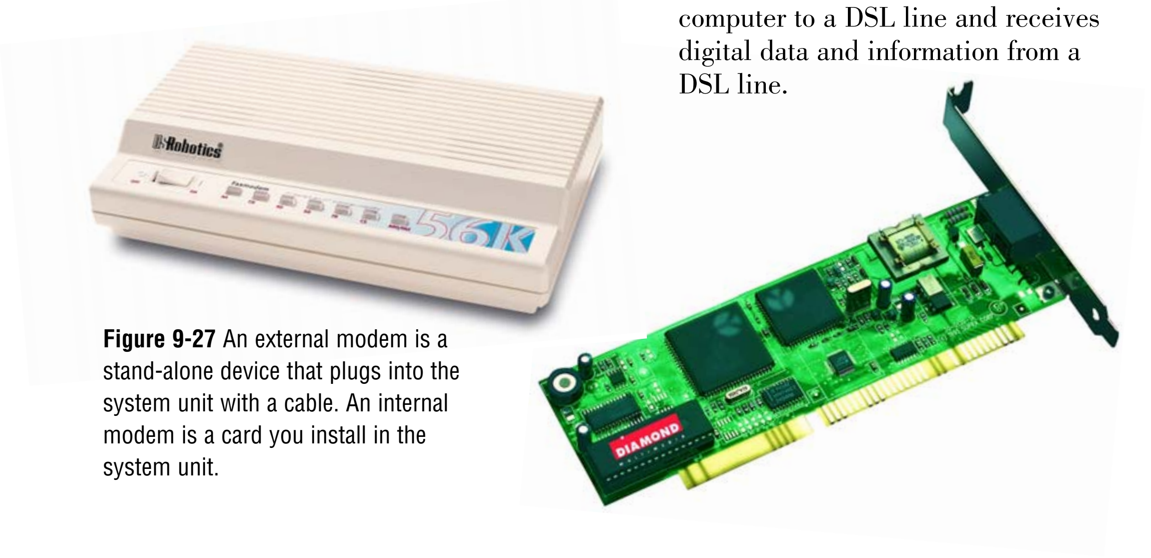


Figure 9-27 An external modem is a stand-alone device that plugs into the system unit with a cable. An internal modem is a card you install in the system unit.

Cable Modems

A **cable modem**, sometimes called a **broadband modem**, is a modem that sends and receives data over the cable television (CATV) network. With more than 100 million homes wired for cable television, cable modems provide a faster Internet access alternative to dial-up for the home user. Cable modems currently can transmit data at speeds much faster than either a dial-up modem or ISDN (see Figure 9-25 on page 9.26). Today, many home and business users are taking advantage of the resources available on the Internet and other networks with high-speed cable service.

As shown in Figure 9-28, CATV service enters your home through a single line. To access the Internet using the cable service, the cable company installs a splitter inside your house. From the splitter, one part of the cable runs to your televisions and the other part connects to the cable modem. A cable modem usually is a stand-alone (separate) device that you connect with a cable to a USB port or a port on a network interface card in your computer. The next section discusses network interface cards.

Network Interface Card

A **network interface card** (**NIC** pronounced nick), also called a **LAN adapter,** is a card you insert into an expansion slot of a personal computer or other device, such as a printer, enabling the device to connect to a network. Personal computers on a LAN typically contain a NIC. The NIC coordinates the transmission and receipt of data, instructions, and information to and from the computer or device containing the NIC.

A NIC works with a particular network technology, such as Ethernet or token ring. An Ethernet card is the most common type of NIC. Depending on the type of wiring used, the transfer rate on an Ethernet network is 10 Mbps, 100 Mbps, or 1,000 Mbps. Ethernet cards typically support one or more of these speeds. Some are called 10/100 because they support both 10 Mbps and 100 Mbps. Some NICs also are a combination Ethernet and dial-up modem card.

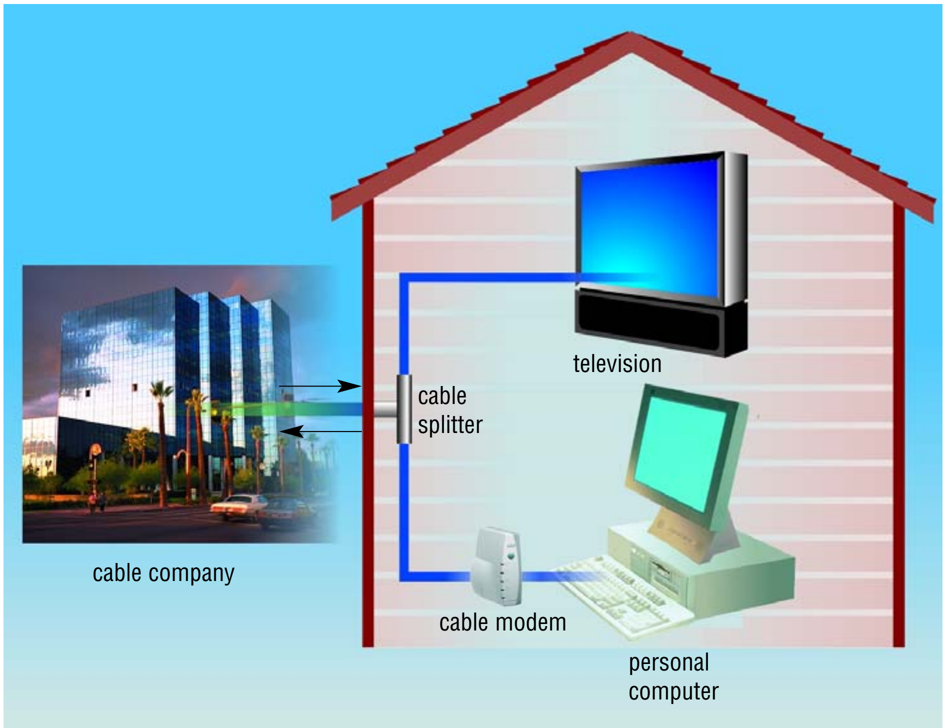


Figure 9-28 A typical cable modem installation.

APPLY IT!

Cable Modem versus DSL

So you are ready to move from the telephone line to a higher-speed Internet connection. Two options are cable modem and digital subscriber line (DSL). Cable modems piggyback on your local television cable connection. DSL uses existing telephone lines. Assuming you live in a geographic area where both options are available, how do you determine which is best for you?

First, DSL and cable share several common features. On the positive side, both approaches offer the benefits of constant connection. Instead of having to dial up every time you need to use the Internet, you are online 24 hours a day. On the negative side, "always on" creates a security issue. This makes your computer vulnerable to hackers who can gain access to your files and drop viruses on your hard disk. DSL is somewhat more secure than cable, but to be safe with either option, install antivirus and firewall software.

In making the decision of cable or DSL, consider several factors.

- Cable Modems
  - Speed – 1 to 2.5 Mbps download;128 to 384 Kbps upload
  - Security – Shared media with others in neighborhood
  - Installation – $75 to $100
  - Monthly Cost – rates vary from $30 to $70
  - Availability – limited to your local cable company
- DSL
  - Speed – 1.54 to 8.45 Mbps download; 128 to 640 Kbps upload
  - Security – dedicated line; no sharing
  - Installation – $100 to $200
  - Monthly Cost – $39 to $110
  - Availability – order service from your local ISP

For more information on cable modem versus DSL, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 9 Apply It #3.

NICs are available in a variety of styles (Figure 9-29). A NIC for a desktop computer has a port where a cable connects. A NIC for notebook and other mobile computers is in the form of a Type II PC Card. Many of these NICs have more than one type of port, enabling different types of cables to attach to the card. For example, some cable modems and DSL modems require that one end of a cable plug into the modem and the other end into a NIC. The NIC for a wireless transmission, by contrast, typically has an antenna.

Connecting Networks

Today, thousands of computer networks exist, ranging from small networks operated by home users to global networks operated by numerous telecommunications firms. To interconnect these many types of networks, various types of communications devices exist. For example, as shown in Figure 9-30, a **hub** is a device that provides a central point for cables in a network.

Web Link

For more information on network interface cards, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click Network Interface Cards.

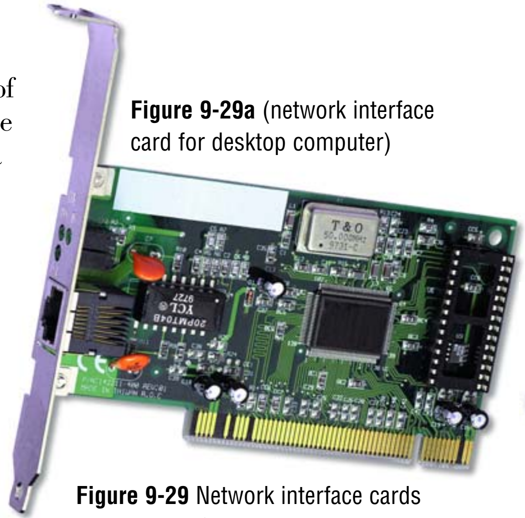


Figure 9-29a (network interface card for desktop computer)

Figure 9-29b (network interface card for notebook computer)

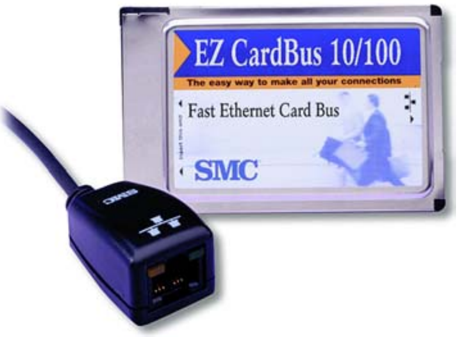


Figure 9-29 Network interface cards are available for both desktop and notebook computers.

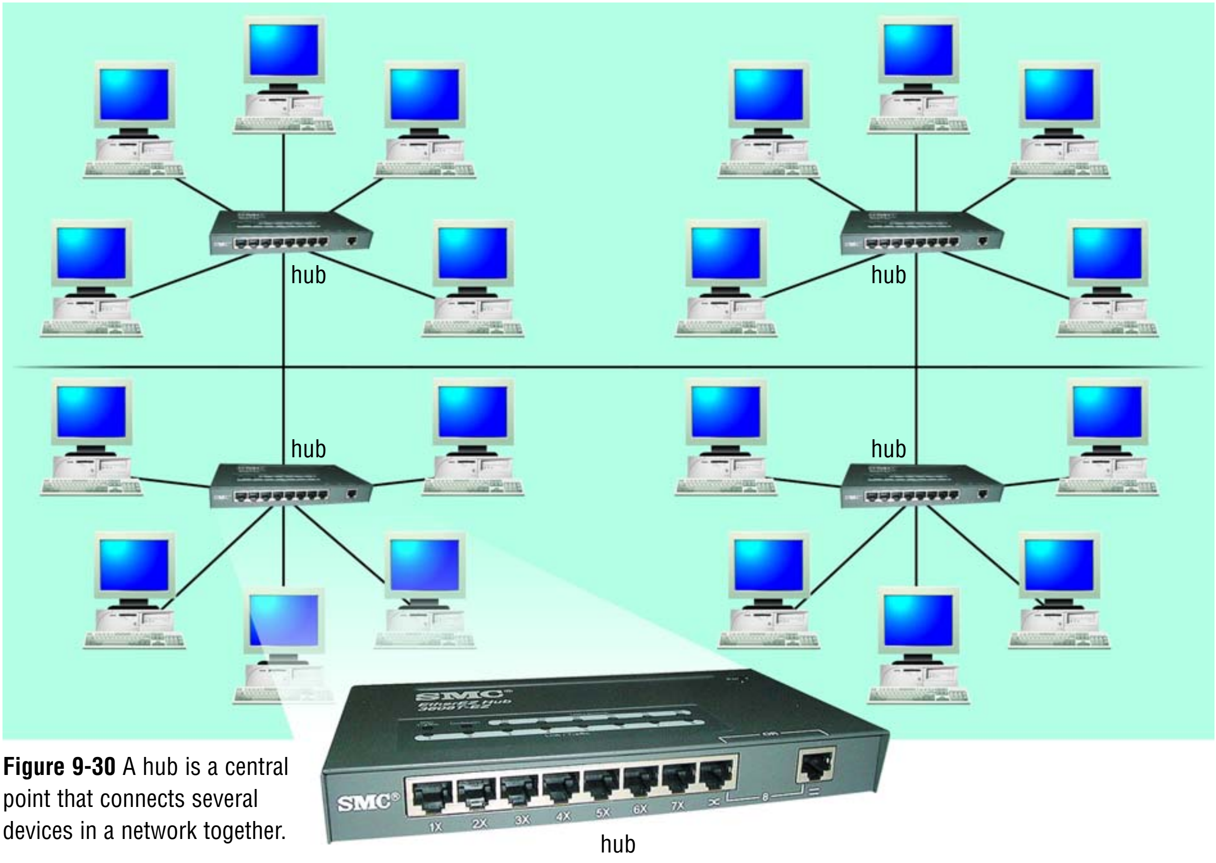


Figure 9-30 A hub is a central point that connects several devices in a network together.

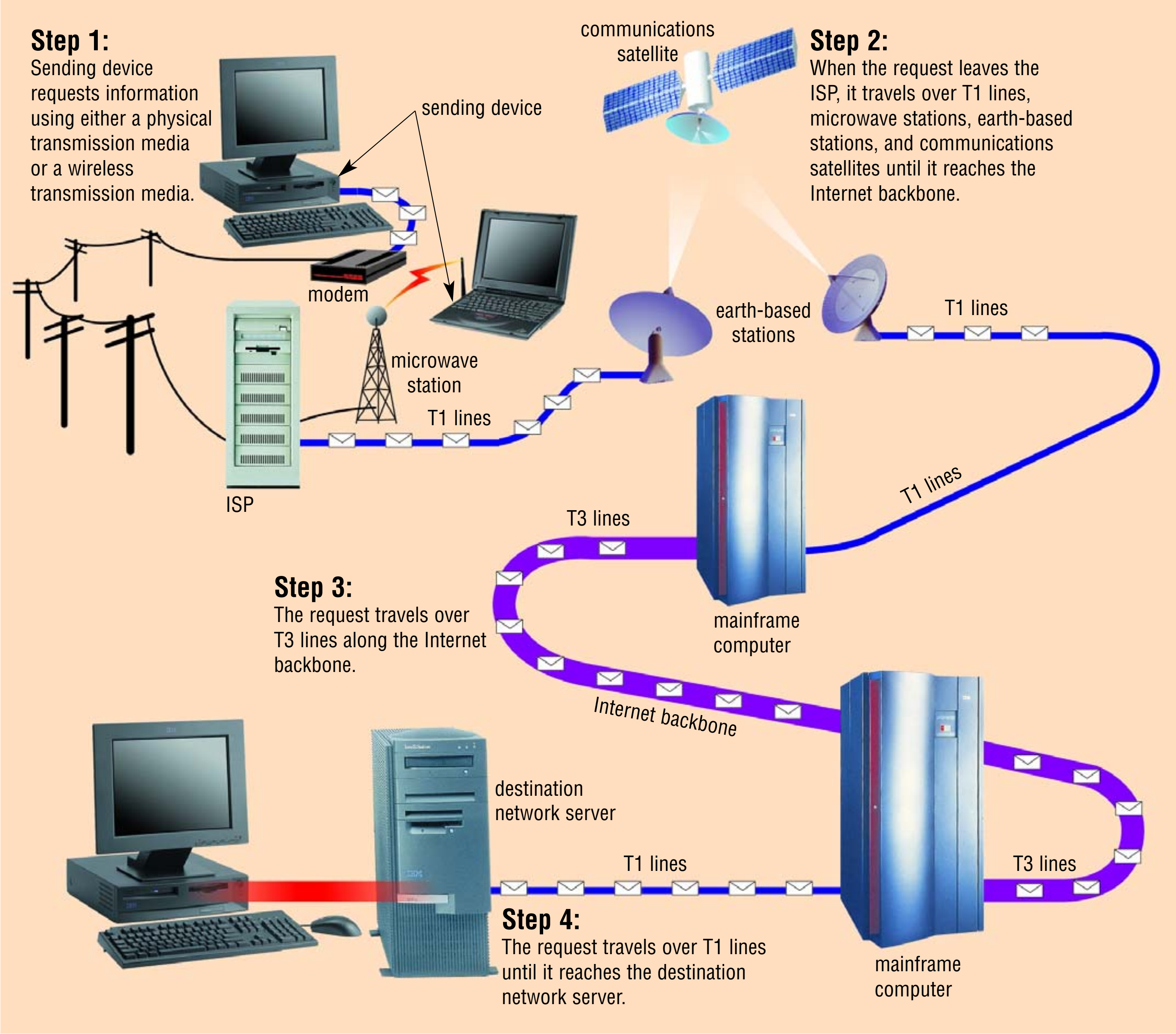
COMMUNICATIONS CHANNEL

An important aspect of communications is the **channel**, which is the communications path between two devices. **Bandwidth** is the width of the communications channel. The higher the bandwidth, the more data and information the channel can transmit.

For transmission of text-based documents, a lower bandwidth delivers acceptable performance. If you transmit music, graphics, photographs, or work with virtual reality or 3-D games, you need a higher bandwidth. When the bandwidth is too low for the application, you will notice a considerable slow-down in system performance.

A communications channel consists of one or more transmission media. **Transmission media** consists of materials or techniques capable of carrying one or more signals. When you send data from your computer to another device, the signal carrying that data most likely travels over a variety of transmission media — especially when the transmission is sent a long distance. Figure 9-31 illustrates a typical communications channel — much like the one that connects a computer to the Internet — and shows the variety of transmission media used to complete the connection. The following pages discuss in depth the media shown

Figure 9-31 AN EXAMPLE OF A COMMUNICATIONS CHANNEL SENDING A REQUEST OVER THE INTERNET



Step 1:
Sending device requests information using either a physical transmission media or a wireless transmission media.

Step 2:
When the request leaves the ISP, it travels over T1 lines, microwave stations, earth-based stations, and communications satellites until it reaches the Internet backbone.

Step 3:
The request travels over T3 lines along the Internet backbone.

Step 4:
The request travels over T1 lines until it reaches the destination network server.

in the figure on the previous page. Although many media and devices are involved, the entire communications process could take less than one second.

Baseband media can transmit only one signal at a time. **Broadband** media can transmit multiple signals simultaneously. Media that use broadband transmit signals at a much faster speed than those that use baseband. Home and business users today are opting for broadband Internet access because of the much faster transfer rates. Two previously discussed services that offer broadband transmission are DSL and the cable television network. Satellites also offer broadband transmission.

Transmission media are one of two types: physical or wireless. **Physical transmission media** use wire, cable, and other tangible (touchable) materials to send communications signals. **Wireless transmission media** send communications signals through the air or space using radio, microwave, and infrared signals. The following sections discuss these types of media.

PHYSICAL TRANSMISSION MEDIA

Physical transmission media used in communications include twisted-pair cable, coaxial cable, and fiber-optic cable. These cables typically are used within buildings or underground. Ethernet and token ring LANs often use physical transmission media. The table in Figure 9-32 lists the transfer rates of LANs using various physical transmission media. The following sections discuss each of these types of cables.

TRANSFER RATES FOR VARIOUS TYPES OF LANs

Type of Cable and LAN	Transfer Rates
Twisted Pair	
• 10Base-T (Ethernet)	10 Mbps
• 100Base-T (Fast Ethernet)	100 Mbps
• 1000Base-T (Gigabit Ethernet)	1000 Mbps
• Token ring	4 – 16 Mbps
Coaxial Cable	
• 10Base2 (ThinWire Ethernet)	10 Mbps
• 10Base5 (ThickWire Ethernet)	10 Mbps
Fiber-Optic Cable	
• 10Base-F (Ethernet)	10 Mbps
• 100Base-FX (Fast Ethernet)	100 Mbps
• FDDI (Fiber Distributed-Data Interface) token ring	100 Mbps

Figure 9-32 The speeds of various physical communications media when they are used in LANs.

Web Link

For more information on bandwidth, visit the Discovering Computers 2002 Chapter 9 WEB LINK page (**scsite.com/dc2002/ch9/weblink.htm**) and click Bandwidth.

COMPANY ON THE CUTTING EDGE

CISCO SYSTEMS

Networking the Internet

The two great equalizers in life are education and the Internet, according to Cisco Systems President and CEO John Chambers. Universal learning opportunities, such as Web-based training and distance education, potentially can unite us and create a borderless society. These prospects are possible, in part, due to Cisco Systems' critical equipment that allows many people to connect to the Internet simultaneously.

In the mid-1990s, Cisco predicted that the Internet would change "the way we work, live, play, and learn." As the world leader in networking solutions, the company strives to empower the Internet generation by connecting people, devices, and networks regardless of differences in locations, time, or types of computers.

Customers are part of three target markets: enterprises with large networking needs, such as corporations and government agencies; service providers that provide information services; and small and medium businesses.

The company began shipping products in 1986 and has grown into a market leader in more than 115 countries. It has the world's largest e-commerce site, with 90 percent of product orders transacted over the Web. Annual revenues exceed $18 billion.

For more information on Cisco Systems, visit the Discovering Computers 2002 Companies Web page (**scsite.com/dc2002/companies.htm**) and click Cisco Systems.

Twisted-Pair Cable

One of the more commonly used transmission media for network cabling and telephone systems is twisted-pair cable. **Twisted-pair cable** consists of one or more twisted-pair wires bundled together (Figure 9-33).

Each **twisted-pair wire** consists of two separate insulated copper wires that are twisted together. The wires are twisted together to reduce noise. **Noise** is an electrical disturbance that can degrade communications.

Coaxial Cable

A second type of physical transmission media is coaxial cable. **Coaxial cable**, often referred to as **coax** (pronounced CO-ax), consists of a single copper wire surrounded by at least three layers: (1) an insulating material, (2) a woven or braided metal, and (3) a plastic outer coating (Figure 9-34).

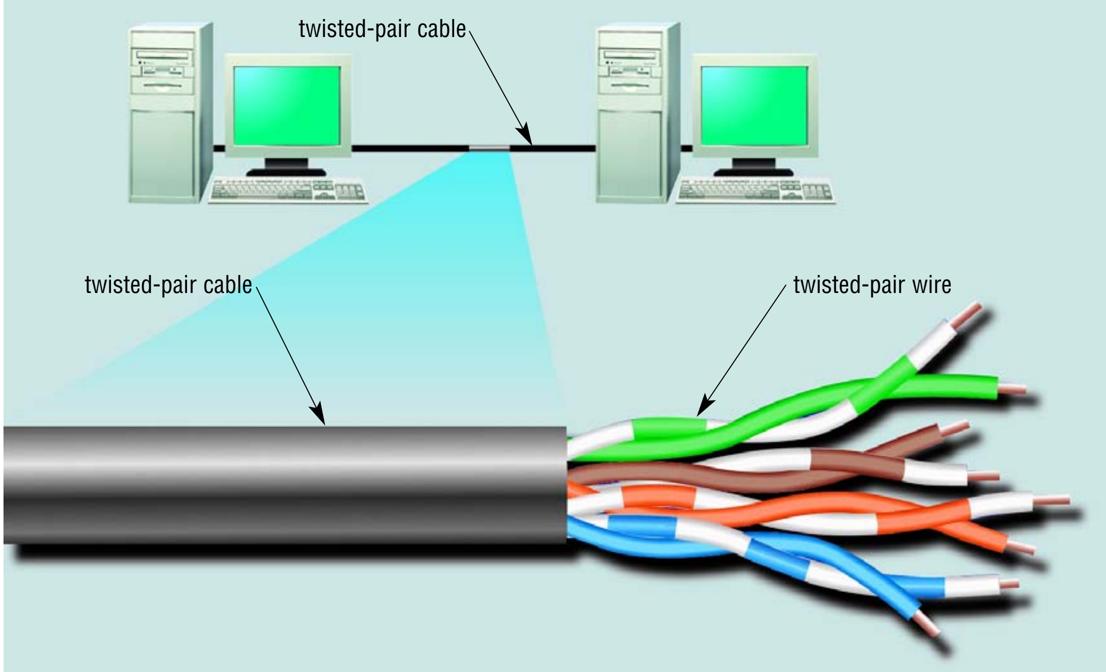


Figure 9-33 A twisted-pair cable consists of one or more twisted-pair wires. Each twisted-pair wire usually is color coded for identification. Telephone networks and local area networks often use twisted-pair cable.

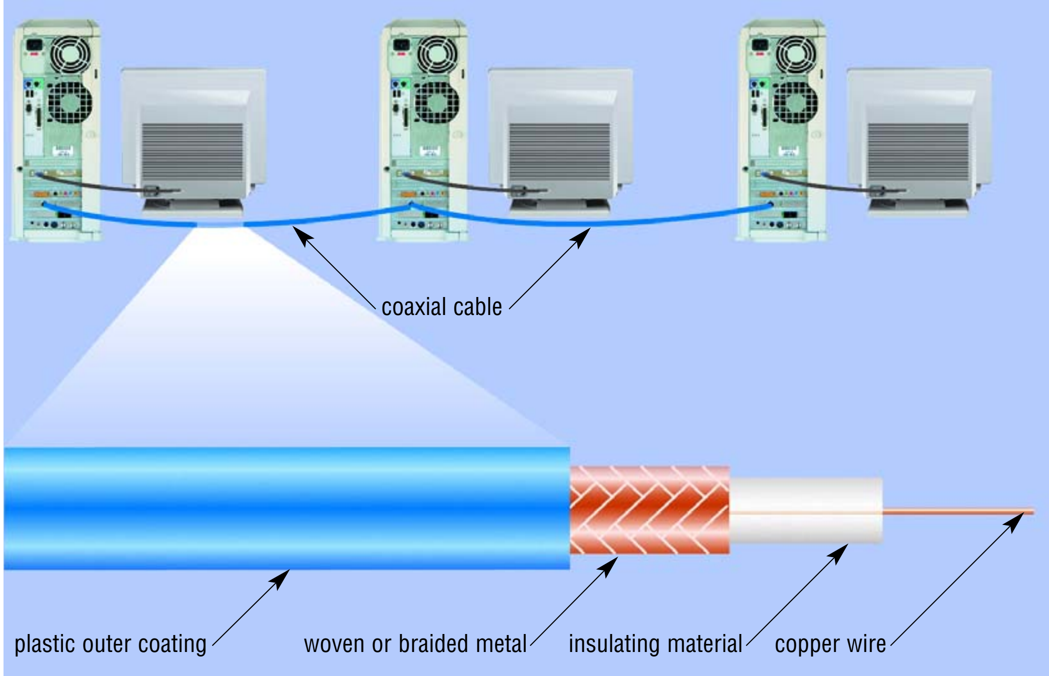


Figure 9-34 On a coaxial cable, data travels through the copper wire. This illustration shows computers networked together with coaxial cable.

Cable television (CATV) wiring often uses coaxial cable because it can be cabled over longer distances than twisted-pair cable. Most of today's computer networks, however, do not use coaxial cable because other transmission media such as fiber-optic cable transmit signals at faster rates.

Fiber-Optic Cable

Another type of physical transmission media is fiber-optic cable. The core of a **fiber-optic cable** consists of dozens or hundreds of thin strands of glass or plastic that use light to transmit signals. Each strand, called an **optical fiber**, is as thin as a human hair. Inside the fiber-optic cable, an insulating glass cladding and a protective coating surround each optical fiber (Figure 9-35).

Fiber-optic cables have several advantages over cables that use wire, such as twisted-pair and coaxial cables. These advantages include the following:

- Capability of carrying significantly more signals than wire cables
- Faster data transmission
- Less susceptible to noise (interference) from other devices such as a copy machine
- Better security for signals during transmission because they are less susceptible to noise
- Smaller size (much thinner and lighter weight)

Disadvantages of fiber-optic cable are it costs more than twisted-pair or coaxial cable and can be difficult to install and modify. Despite these limitations, many local and long-distance telephone companies and cable television operators are replacing existing telephone and coaxial cables with fiber-optic cables. Many businesses also are using fiber-optic cables in high-traffic networks or as the main cable in a network.

WIRELESS TRANSMISSION MEDIA

Wireless transmission media are used when it is inconvenient, impractical, or impossible to install cables. Wireless transmission media used in communications include broadcast radio, cellular radio, microwaves, communications satellites, and infrared. The table in Figure 9-36 lists transfer rates of various wireless transmission media. The following sections discuss these types of wireless transmission media. The special feature following this chapter illustrates a series of wireless applications.

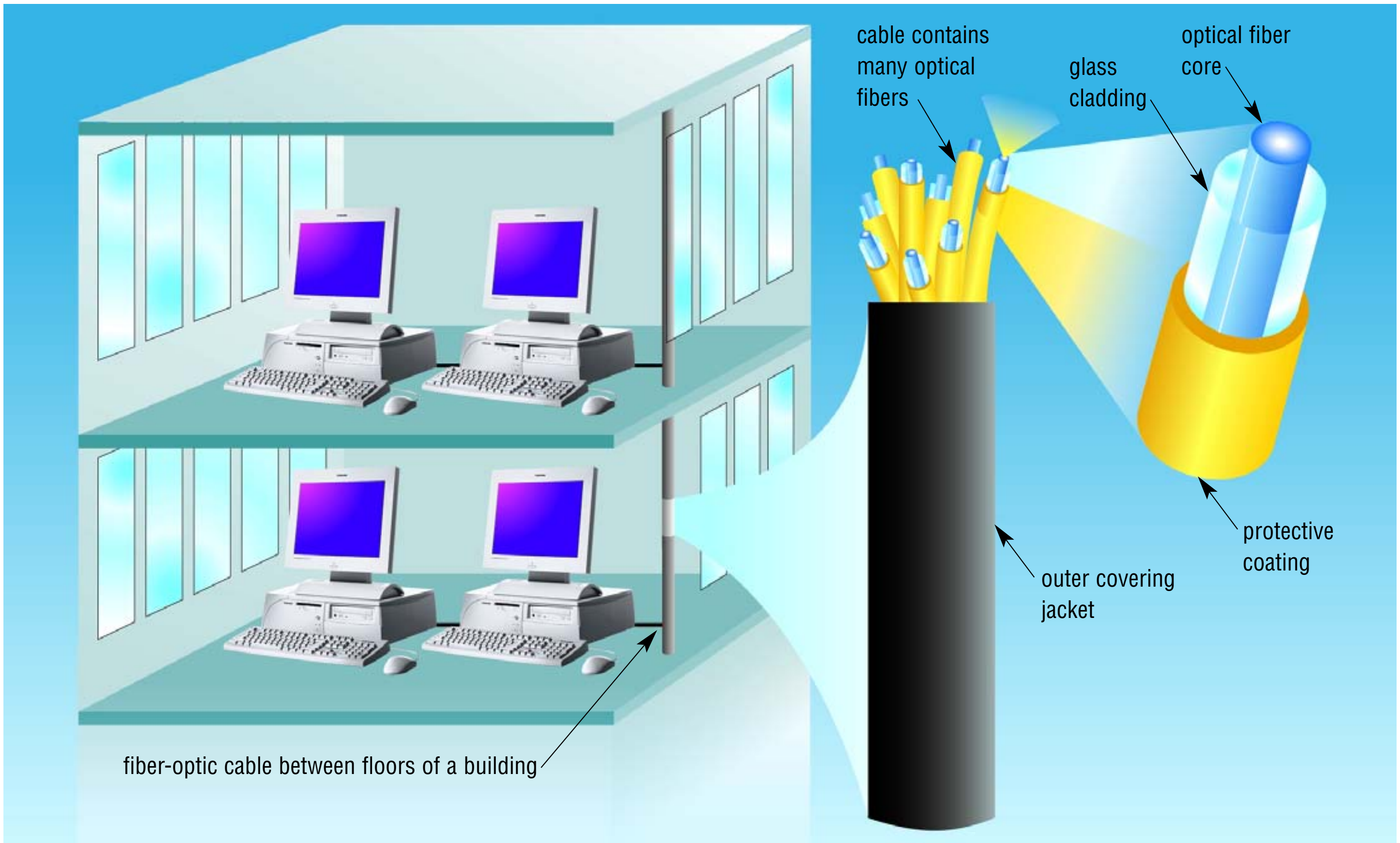

cable contains many optical fibers
glass cladding
optical fiber core
protective coating
outer covering jacket
fiber-optic cable between floors of a building

Figure 9-35 A fiber-optic cable consists of hair-thin strands of glass or plastic that carry data as pulses of light.

Broadcast Radio

Broadcast radio is a wireless transmission medium that distributes radio signals through the air over long distances such as between cities, regions, and countries and short distances such as within an office or home. For radio transmissions, you need a transmitter to send the broadcast radio signal and a receiver to accept it. To receive the broadcast radio signal, the receiver has an antenna that is located in the range of the signal. Some networks use a **transceiver**, which both sends and receives signals from wireless devices. Broadcast radio is slower and more susceptible to noise than physical transmission media but it provides flexibility and portability.

TRANSFER RATES FOR VARIOUS TYPES OF WIRELESS TRANSMISSION MEDIA

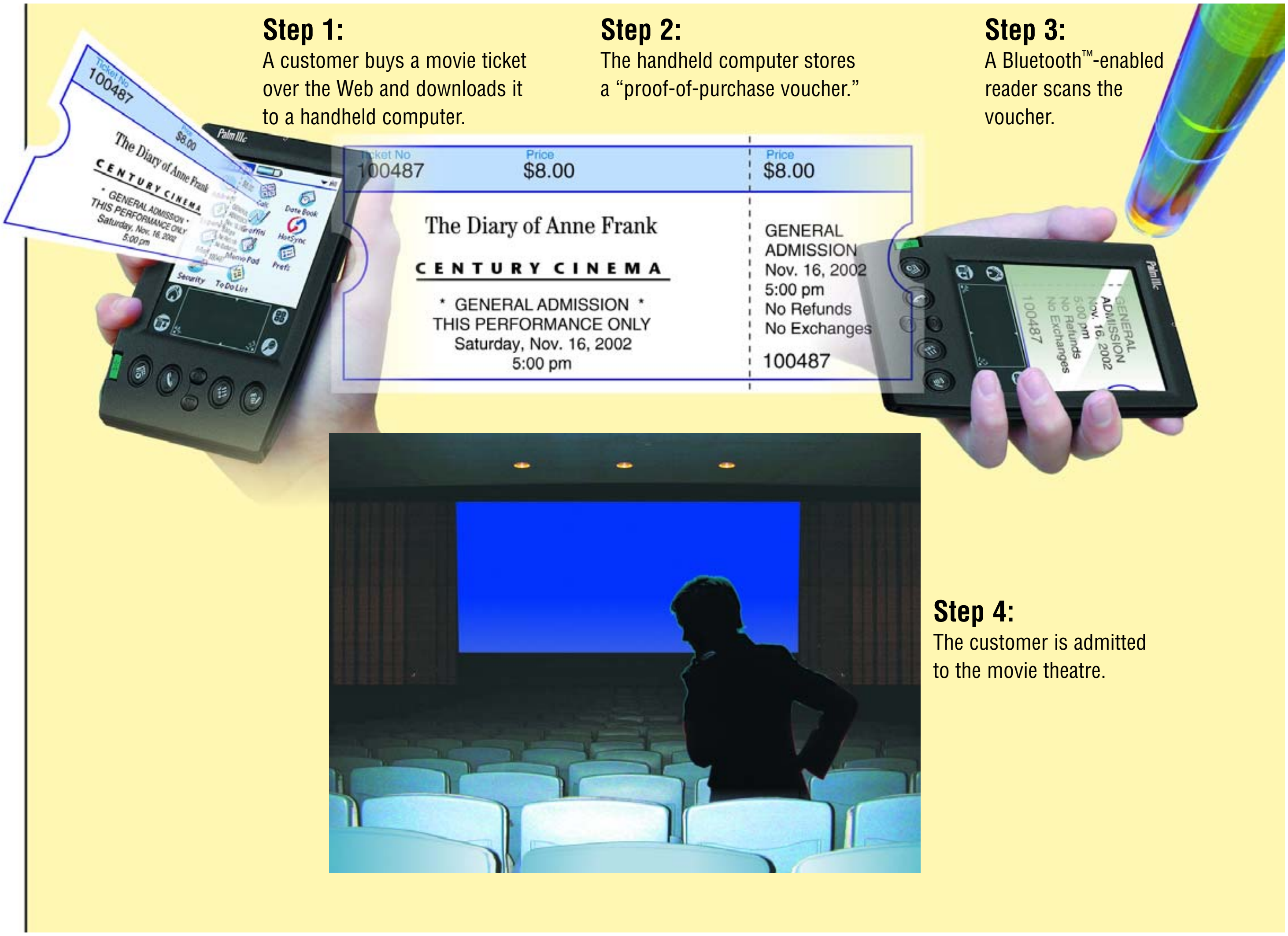
Channel	Transfer Rates
Broadcast radio	Up to 2 Mbps
Microwave radio	45 Mbps
Communications satellite	50 Mbps
Cellular radio	9,600 bps to 14.4 Kbps
Infrared	1 to 4 Mbps

Figure 9-36 The speeds of various wireless communications media.

Home and small business users are finding many uses for short-range broadcast radio communications such as Bluetooth™. **Bluetooth™** uses short-range radio waves to transmit data among Bluetooth™-enabled devices. A Bluetooth™-enabled device contains a small chip that allows it to communicate with other Bluetooth™-enabled devices. Examples of these devices can include desktop personal computers, Internet appliances, notebook computers, handheld computers, cellular telephones, fax machines, and printers. To communicate with each other, these devices must be within a specified range (about 10 meters but can be extended to 100 meters with additional equipment).

Figure 9-37 illustrates how users can *buy* movie tickets on the

Figure 9-37 AN EXAMPLE OF A BLUETOOTH™ USE FOR SHORT-RANGE RADIO TRANSMISSION



Step 1:
A customer buys a movie ticket over the Web and downloads it to a handheld computer.

Step 2:
The handheld computer stores a "proof-of-purchase voucher."

Step 3:
A Bluetooth™-enabled reader scans the voucher.

Step 4:
The customer is admitted to the movie theatre.

Web, save the ticket on their handheld computer, and then transfer the ticket using short-range radio Bluetooth™ technology to a Bluetooth-reader at the movie theater when they wish to see the movie.

As discussed earlier in this chapter, many homes and businesses today are using broadcast radio to wirelessly network computers and other devices in the household or office. Figure 9-38 shows a sample wireless local area network. Wireless devices such as terminals, notebook computers, or handheld computers have an antenna so they can communicate with the network transceiver.

Cellular Radio

Cellular radio is a form of broadcast radio that is used widely for mobile communications, specifically wireless modems and cellular telephones (Figure 9-39). A **cellular telephone** is a telephone device that uses radio signals to transmit voice

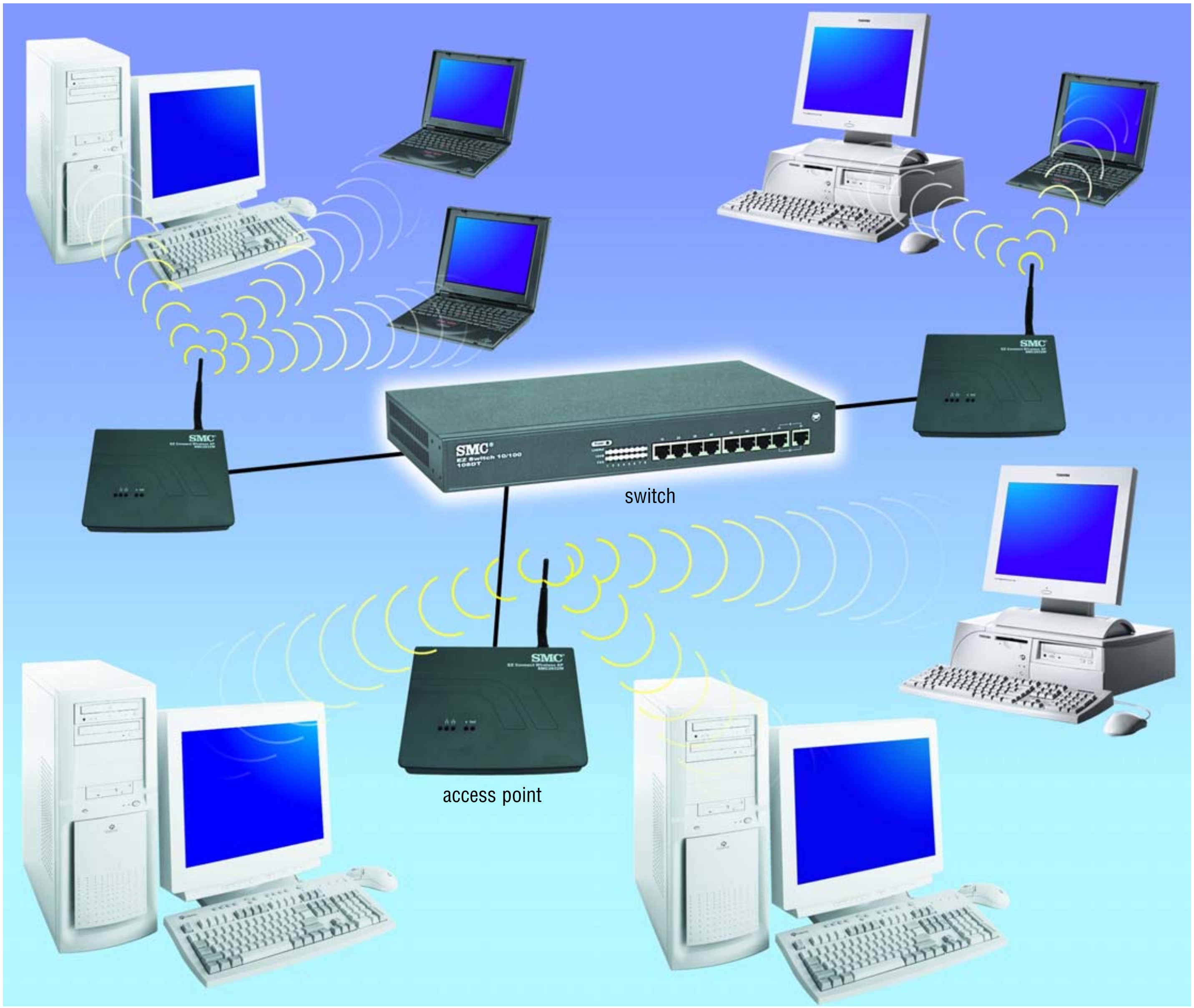


Figure 9-38 A sample wireless local area network.

and digital data messages. Some mobile users connect their notebook computer or other mobile computer to a cellular telephone to access the Web, send and receive e-mail, enter a chat room, or connect to an office or school network while away from a standard telephone line, for example, from a car or a park bench.

Personal Communications Services (**PCS**) is a set of technologies used for completely digital cellular devices. Devices that use PCS include handheld computers, cellular telephones, pagers, and fax machines. These devices have voice mail, call forwarding, fax capability, and caller ID. They also have wireless modems allowing you Internet access and e-mail capabilities.

Microwaves

Microwaves are radio waves that provide a high-speed signal transmission. Microwave transmission involves sending signals from one microwave station to another (Figure 9-40 on the next page). Microwaves can transmit data at rates up to 4,500 times faster than a dial-up modem.

A **microwave station** is an earth-based reflective dish that contains the antenna, transceivers, and other equipment necessary for microwave communications. Microwaves use **line-of-sight transmission**, which means that microwaves must transmit in a straight line with no obstructions between microwave antennas. To avoid possible obstructions, such as buildings or mountains, microwave stations often sit on the tops of buildings, towers, or mountains.

Microwave transmission is used in environments where installing physical transmission media is difficult or impossible and where line-of-sight transmission is available.

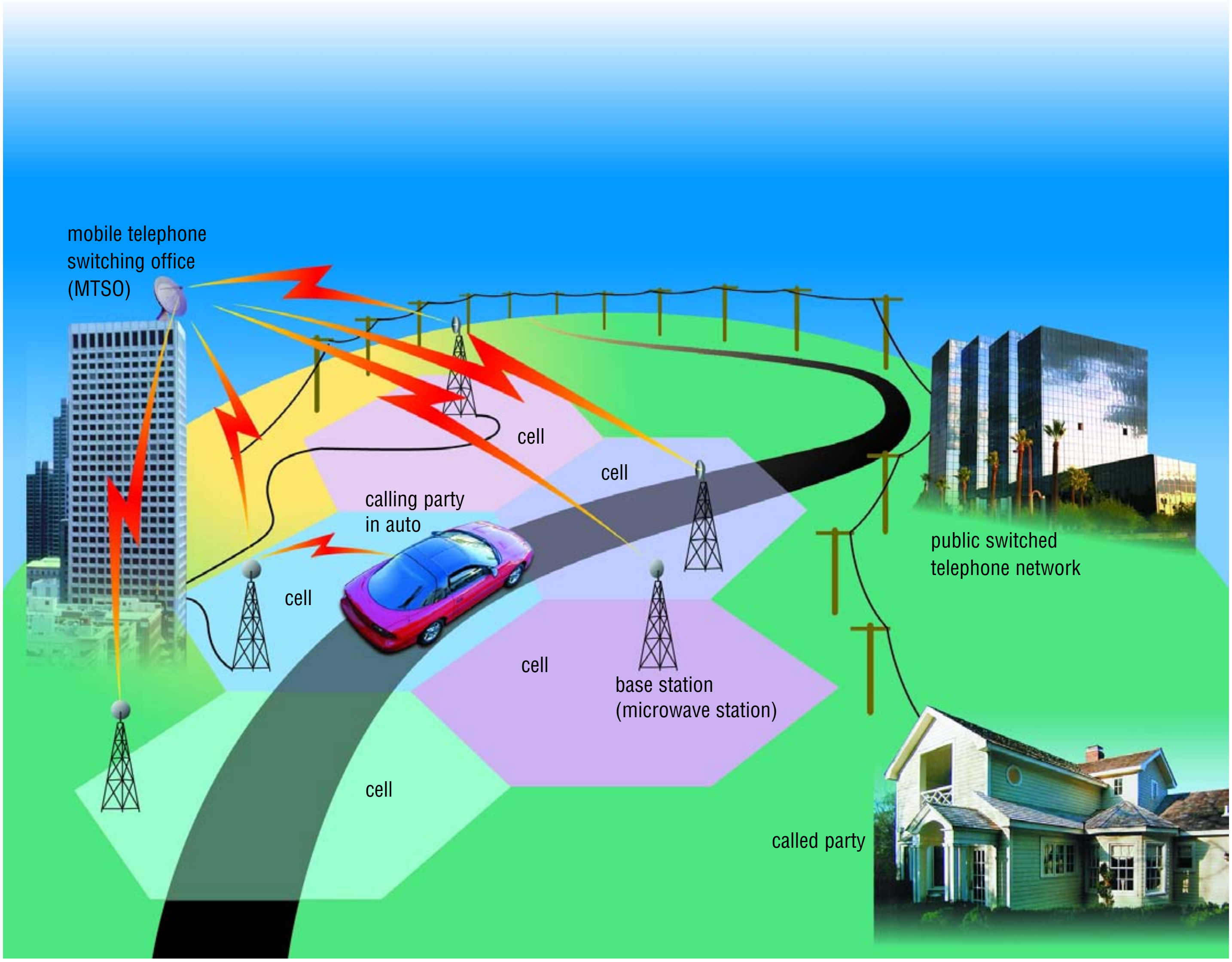


Figure 9-39 As a person with a cellular telephone drives from one cell to another, the radio signals transfer from the base station (microwave station) in one cell to a base station in another cell.

For example, microwave transmission is used in wide-open areas such as deserts or lakes; between buildings in a close geographic area; or to communicate with a satellite. Current users of microwave transmission include universities, hospitals, city governments, cable television providers, and telephone companies.

Communications Satellite

A **communications satellite** is a space station that receives microwave signals from an earth-based station, amplifies (strengthens) the signals, and broadcasts the signals back over a wide area to any number of earth-based stations (Figure 9-41).

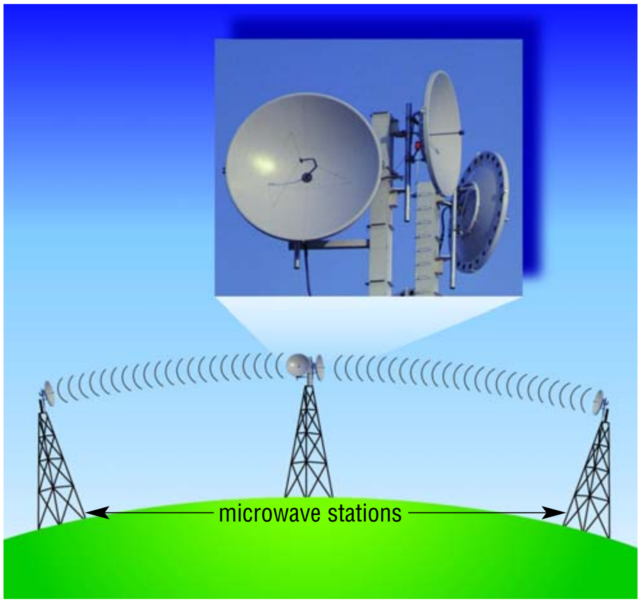


Figure 9-40 A microwave station is an earth-based reflective dish that contains the antenna and other equipment necessary for microwave communications.

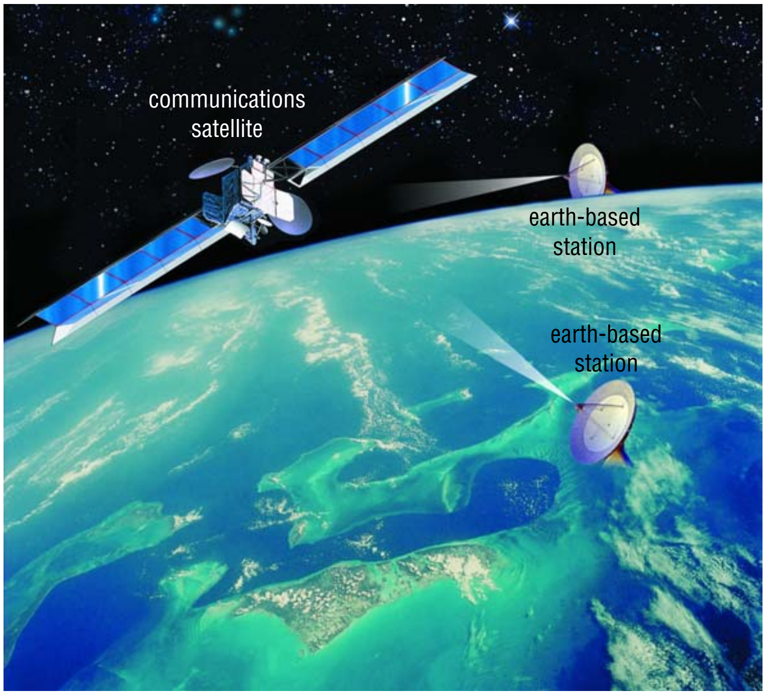


Figure 9-41 Communications satellites are placed about 22,300 miles above the Earth's equator.

ISSUE

Wireless Advertising

Cellular Radio

Are you ready for wireless advertising? You are on the road and need to call home. You dial your cellular telephone just as you pass a Pizza Hut. The first words you hear? "The Best Pizza Under One Roof." This scenario may seem a little futuristic, but today's technology makes it possible to deliver targeted advertising in all sorts of new ways. WindWire and DoubleClick (see URLs below), for example, both have wireless marketing and advertising networks that deliver targeted advertisements, coupons, and promotions to leading wireless Internet devices, including cellular telephones, handheld computers, and two-way pagers. Ericsson Telephone (see URL below) recently conducted a six-week wireless advertising study with 5,000 users. In return for the more than 100,000 targeted advertising messages, the users were given free text-messaging capabilities. The results of the study indicate more than 60 percent of the participants liked receiving targeted advertisements, and 20 percent asked for more information after viewing the advertising message. Will American users willingly accept wireless advertisements sent to them over cellular telephones and other mobile devices? What inducement would convince someone to accept the messages? Free air time? Free information such as the location of a restaurant? Would you accept the advertising in return for a free service? What if the advertisements were targeted at your personal profile? Would this make a difference in your willingness to accept the advertisements?

For more information on wireless devices and wireless advertising and the Web sites mentioned above, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 9 Issue #5.

These earth-based stations often are microwave stations. Other devices, such as handheld computers and GPS receivers, also can function as an earth-based station. Transmission from an earth-based station to a satellite is an **uplink**. Transmission from a satellite to an earth-based station is a **downlink**.

Applications such as air navigation, television and radio broadcasts, videoconferencing, paging, and global positioning systems use communications satellites. With the proper satellite dish and a satellite modem card, consumers can access the Internet using satellite technology. Web satellites, however, only can transmit to your computer (one-way communications). For uplink transmissions, you more than likely will use a dial-up modem. This difference in speeds usually is acceptable to most Internet satellite users because they download much more data than they upload. Future satellite technology will allow for two-way communications.

Infrared

Infrared (**IR**) is a wireless transmission media that sends signals using infrared light waves. Similar to microwaves, infrared transmission requires a line-of-sight transmission. That is, the sending device and the receiving device must be in line with each other so that nothing obstructs the path of the infrared light wave.

As discussed in Chapter 4, many computers and devices, such as a mouse, printer, and digital camera, have an IrDA port that enables the transfer of data from one device to another using infrared light waves. If your notebook computer has an IrDA port, simply position the port in front of the IrDA port on a printer to print a document wirelessly. Many handheld computers also have IrDA ports, allowing you to transfer data to another handheld computer or a network wirelessly (Figure 9-42).

CHAPTER SUMMARY

This chapter provided an overview of communications terminology and applications. It also discussed how you can join computers together into a network, allowing them to communicate and share resources such as hardware, software, data, and information. It also explained various communications devices, media, and procedures as they relate to computers.

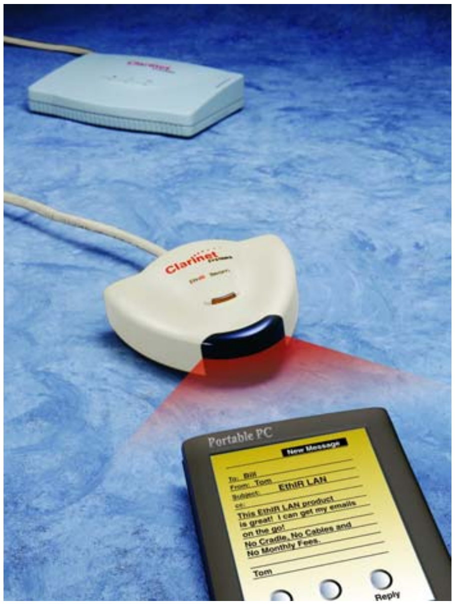

Clarinet
Portable PC
New Message
To: Bill
From: Tom
Subject: EthIR LAN
cc:
This EthIR LAN product is great! I can get my emails on the go!
No Cradle, No Cables and No Monthly Fees.
Tom
Reply

Figure 9-42 Many handheld computers have IrDA ports, allowing users to transmit business cards wirelessly to each other's handheld computer.

Data Communications Analyst

As a data communications analyst, you would aid in the research, design, installation, maintenance, and troubleshooting of data networks such as LANs and WANs. Common environments include voice, fiber optics, and TCP/IP. The analyst assists users with connectivity problems, analyzes data flow, configures modems, routers, and other devices. Experience with Cisco routers, switches, firewalls, and other data communications equipment is a plus. Someone who works in the field needs knowledge of various network operating systems and strong problem-solving skills.

Educational requirements vary widely from company to company. Some analysts have a two-year community college degree while others have a degree in electrical engineering. Similarly, a wide variation exists in salaries. Those with more education and experience earn more. Salaries range anywhere from $40,000 to $80,000.

To learn more about the field of data communications analyst as a career, visit the Discovering Computers 2002 Careers Web page (**scsite.com/dc2002/careers.htm**) and click Data Communications Analyst.

E-LEARNING

YEARN TO LEARN

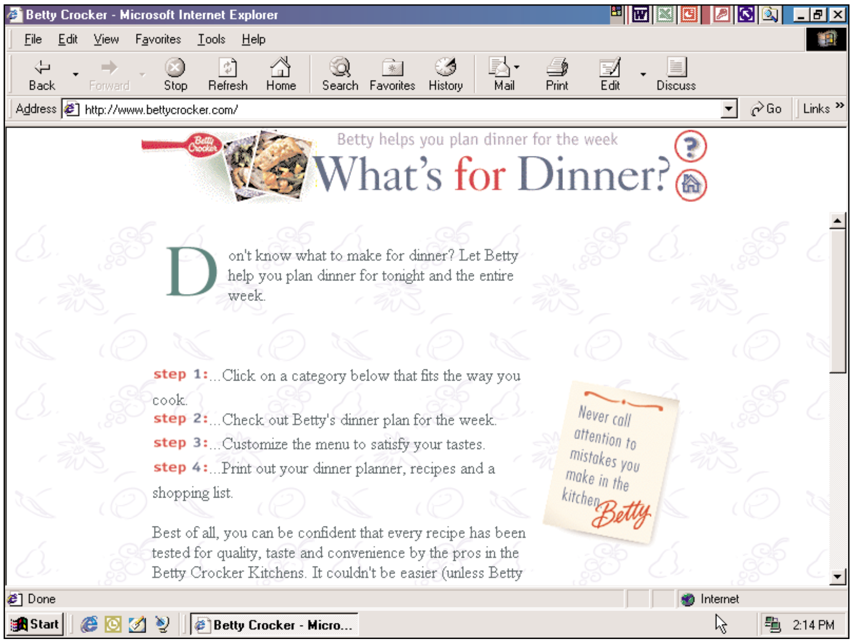
Discover New Worlds Online

"To try and fail is at least to learn. To fail to try is to suffer the loss of what might have been." Benjamin Franklin's words bring home the point that despite setbacks encountered along the way, learning nurtures the creative spirit and helps people grow.

While you may believe your education ends when you finally graduate from college, learning is a lifelong process. Although much of this learning may occur on the job and through personal experiences, the Internet can fuel much of your desire and need to expand your mind. Many Web sites use streaming media and graphic-intense applications, so the high-speed Internet connections discussed in this chapter, such as cable modems and DSL, are ideal for these e-learning tools.

Learning to enhance your culinary skills can be a rewarding endeavor. No matter if you are a gourmet chef or a weekend cook, you will be cooking in style with the help of online resources. At the Betty Crocker Web site (Figure 9-43), you can learn how to prepare nutritious meals and bake for special occasions, almost as if Betty Crocker herself were guiding you along. If you find your kitchen familiar territory, The MasterCook's video tips can add flair and finesse to your style.

If you would rather sit in front of the computer than stand in front of the stove, you can learn to search the Internet skillfully and delve into its treasures by visiting several Web sites, including Learn the Net (Figure 9-45) and NetLearn. These learning Web sites offer tutorials on building your own Web sites, the latest news about the Internet, and resources for visually impaired users.


Betty Crocker - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address
Go
Links
Betty Crocker
Done
Internet
Start
Betty Crocker - Micro...
2:14 PM

http://www.bettycrocker.com/

Betty helps you plan dinner for the week

What's for Dinner?

Don't know what to make for dinner? Let Betty help you plan dinner for tonight and the entire week.

step 1:...Click on a category below that fits the way you cook.

step 2:...Check out Betty's dinner plan for the week.

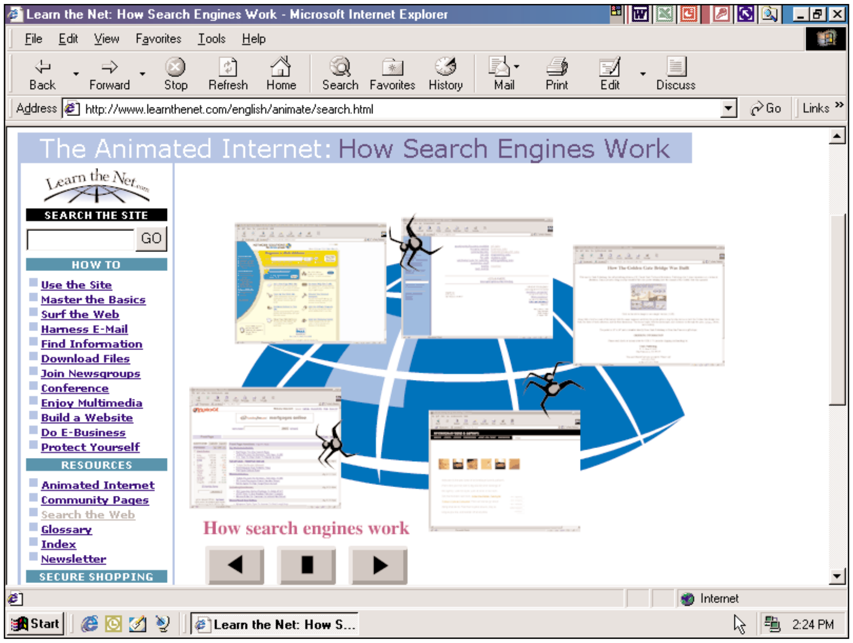
step 3:...Customize the menu to satisfy your tastes.

step 4:...Print out your dinner planner, recipes and a shopping list.

Best of all, you can be confident that every recipe has been tested for quality, taste and convenience by the pros in the Betty Crocker Kitchens. It couldn't be easier (unless Betty

Never call attention to mistakes you make in the kitchen Betty

Figure 9-43 From soups to soufflés, cooking will be a piece of cake with tips from the Betty Crocker and other culinary Web sites.



http://www.learnthenet.com/english/animate/search.html

The Animated Internet: How Search Engines Work

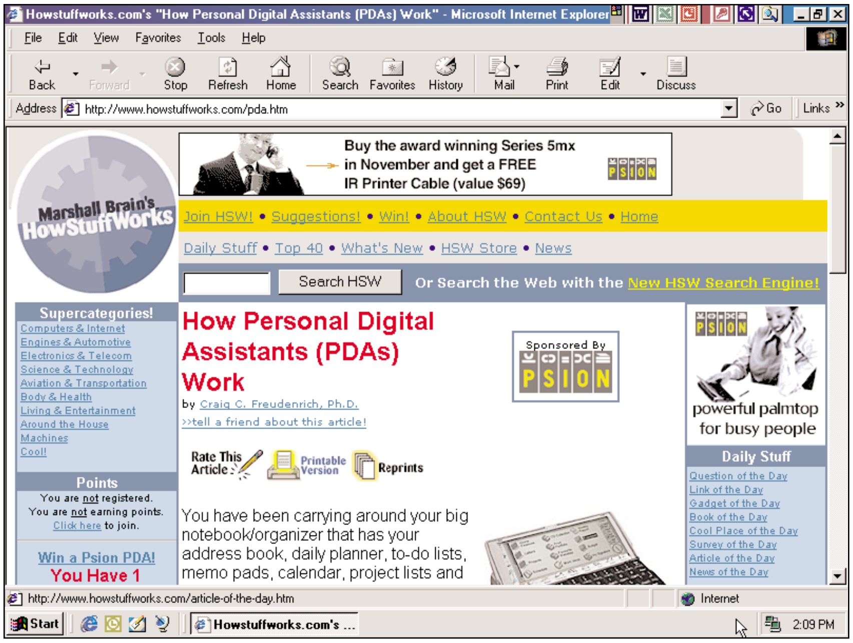
How search engines work

Figure 9-44 Web sites such as Learn the Net make navigating the Web a more rewarding experience.

Have you ever wondered how an airplane flies? Take a look at the See How it Flies Web site. You might be interested in finding out about how your car's catalytic converter reduces pollution or how the Electoral College functions? Marshall Brain's How Stuff Works Web site (Figure 9-45) is filled with articles and animations.

The table in Figure 9-46 lists some innovative and informative learning Web sites. Have a seat in this virtual classroom, and do not be afraid to fail along the way.

For more information on learning Web sites, visit the Discovering Computers 2002 E-Revolution Web page (scsite.com/dc2002/e-rev.htm) and click Learning.


Howstuffworks.com's "How Personal Digital Assistants (PDAs) Work" - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://www.howstuffworks.com/pda.htm
Go Links
Marshall Brain's HowStuffWorks
Buy the award winning Series 5mx in November and get a FREE IR Printer Cable (value $69)
PSION
Join HSW! • Suggestions! • Win! • About HSW • Contact Us • Home
Daily Stuff • Top 40 • What's New • HSW Store • News
Search HSW
Or Search the Web with the New HSW Search Engine!
Supercategories!
Computers & Internet
Engines & Automotive
Electronics & Telecom
Science & Technology
Aviation & Transportation
Body & Health
Living & Entertainment
Around the House
Machines
Cool!
Points
You are not registered.
You are not earning points.
Click here to join.
Win a Psion PDA!
You Have 1
Sponsored By PSION
powerful palmtop for busy people
Daily Stuff
Question of the Day
Link of the Day
Gadget of the Day
Book of the Day
Cool Place of the Day
Survey of the Day
Article of the Day
News of the Day
Rate This Article
Printable Version
Reprints
http://www.howstuffworks.com/article-of-the-day.htm
Internet
Start
Howstuffworks.com's ...
2:09 PM

How Personal Digital Assistants (PDAs) Work

by Craig C. Freudenrich, Ph.D.

>>tell a friend about this article!

You have been carrying around your big notebook/organizer that has your address book, daily planner, to-do lists, memo pads, calendar, project lists and

Figure 9-45 The Internet has something for everyone with numerous Web sites that help you find information quickly and easily about how technology works, the principles of flight, or educational adventures.

LEARNING WEB SITES	URL
Cooking	
Betty Crocker	bettycrocker.com
SierraHome Network MasterCook.com	mastercook.sierrahome.com
Internet	
Learn the Net	learnthenet.com
NetLearn	www.rgu.ac.uk/schools/sim/research/netlearn/callist.htm
Technology and Science	
Global Online Adventure Learning Site	goals.com/homebody.asp
How Stuff Works	howstuffworks.com/welcome.htm
General Learning	
Bartleby.com: Great Books Online	bartleby.com
Blue Web'n Learning Sites Library	www.kn.pacbell.com/wired/bluewebn

For an updated list of learning Web sites, visit scsite.com/dc2002/e-rev.htm.

Figure 9-46 These Web sites contain a variety of topics that can help you learn about all aspects of life.

eREVOLUTION E-LEARNING applied:

1. Visit one of the three cooking Web sites listed in Figure 9-46 and find two recipes or cooking tips that you can use when preparing your next meal. Write a paragraph on each summarizing your discoveries. What are the advantages and disadvantages of accessing these Web sites on the new Web appliances that might someday be in your kitchen?

2. Using one of the technology and science Web sites and one of the Web sites in Figure 9-46, search for information about communications and networks that supplements the material discussed in this chapter. Write a paragraph about your findings. Then, review the material in the two general learning Web sites listed in Figure 9-46, and write a paragraph describing the content on each Web site that is pertinent to your major.

In Summary

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch9/summary.htm. Click the links for current and additional information. To listen to an audio version of this In Summary, click the Audio button. To play the audio, RealPlayer must be installed on your computer (download by clicking here).

1 What Components Are Required for Successful Communications?

When referring to computers, **communications** describes a process in which one computer transfers data, instructions, and information to another computer(s). Communications requires a **sending device** that initiates the transfer; a communications device (such as a modem) that converts the sent material into signals capable of being carried by a communications channel; a communications channel over which the signals travel; a communications device that receives the signals and converts them into a form understood by the **receiving device**, which accepts the sent material.

2 What Are Some Sending and Receiving Devices?

Notebook computers, desktop computers, mid-range servers, and mainframe computers all can serve as sending and receiving devices. **Internet appliances** and Web-enabled devices also serve as sending and receiving devices. Cellular telephones and pagers are examples of wireless devices that can be Web enabled.

3 What Are Some Communications Applications?

Voice mail functions similarly to answering machine but converts an analog voice message into digital form. A **fax** sends and receives documents via telephone lines, and a fax modem sends and receives faxes using a computer. **E-mail** (**electronic mail**) is the exchange of text messages and computer files via a communications network. **Instant messaging** (**IM**) is a communications service that notifies you when people are online and allows you to exchange messages or files. In a **chat room**, participants use the computer to converse with each other in real time. **Internet telephony** uses the Internet instead of the telephone to enable you to talk to other people over the Web. **Videoconferencing** uses video and computer technology to conduct a meeting between participants at geographically separate locations. A **Web conference** uses the Internet, Web browsers, and Web servers. **Groupware** is a software application that helps people work together and share information over a network. A **global positioning system (GPS)** consists of earth-based receivers that analyze satellite signals to determine the receiver's geographic location.

4 What Are the Advantages of Using a Network?

A **network** is a collection of computers and devices connected by communications channels that facilitates communications among users and allows users to share resources with other users. Using a network enables people to communicate efficiently and easily, both internally and externally. Each user on a network can share hardware, software, data, and information.

5 What Is the Difference between a Local Area Network and a Wide Area Network?

A **local area network** (**LAN**) is a network that connects computers and devices in a limited geographical area such as a home, school computer laboratory, office building, or closely positioned group of buildings. Two popular types of LANs are **peer-to-peer** and **client/server**. A **wide area network (WAN)** covers a large geographical area (such as a city, country, or the world) using a communications channel that combines many types of media such as telephone lines, cables, and air waves.

6 What Are the Various Types of Communications Technologies?

To communicate effectively requires that a network uses a variety of communications technologies. **Ethernet**, the most poplar LAN, is based on a bus topology, but can be wired in a star pattern. This LAN technology enables personal computers to contend for access to the network. Variations of the Ethernet standard include **Fast Ethernet** and **Gigabit Ethernet**. **Token ring** controls access to the network by requiring that network devices share or pass a token or special signal to access the network. Internet transmissions commonly use **transmission control protocol/Internet protocol**, or **TCP/IP**, to manage data transmission by breaking it up into packets. The Wireless Application Protocol (WAP) uses a client/server network and allows wireless mobile devices to access the Internet and its services such as the Web and e-mail.

7 What Are Some Uses for Intranets and Extranets?

Intranets generally make company information accessible to employees and facilitate working in groups. Simple intranet applications include electronic publishing of organizational materials such as telephone directories, event calendars, procedure manuals, employee benefits information, and job postings. An **extranet** is a type of network that extends to authorized users outside the company. Extranets facilitate communications among a company's customers or suppliers. A firewall restricts access to data and information on a network.

8 What Is the Purpose of Communications Software?

Communications software establishes a connection to another computer or network, and manages the transmission of data, instructions, and information. For two computers to communicate, they must have compatible communications software. Once a connection is established, communications software provides a means to access the Internet. Some communications programs support **FTP (file transfer protocol)**, which is an Internet standard that enables the uploading and downloading of files to and from a Web server.

9 How Does the Telephone Network Work?

The public switched telephone network (PSTN) is the worldwide telephone system that handles voice-oriented telephone calls. With the exception of the final link from the local telephone company to the home, today's system is mostly digital. Data, instructions, and information are sent over the telephone network using a **dial-up line** or a **dedicated line**. The **transfer rate** is the speed with which a line carries data and information, and rates can range from thousands of **bits per second (bps)** to billions of bits per second. Four popular types of digital dedicated lines are **ISDN** (Integrated Services Digital Network), **DSL** (**digital subscriber line**), **T-carrier line**, and **asynchronous transfer mode** (**ATM**).

10 What Are Commonly Used Communications Devices?

A **communications device** is any type of hardware capable of transmitting data, instructions, and information between a sending device and a receiving device. A modem converts a computer's digital signals into analog signals (**modulate**) so they can be transmitted over standard telephone lines, and then reconverts the analog signals into digital signals (**demodulate**) that a computer can understand. ISDN and DSL use a **digital modem** that sends and receives data and information to and from a digital telephone line. A **cable modem** sends and receives data over the cable television (CATV) network. A **network interface card** (**NIC**) is a card inserted into an expansion slot of a personal computer or other device, enabling the device to connect to a network.

11 What Are Various Types of Transmission Media?

Transmission media consists of materials or techniques capable of carrying signals. **Physical transmission media**, which use tangible (touchable) materials to send communications signals, include twisted-pair cable, coaxial cable, and fiber-optic cable. **Twisted-pair cable** consists of twisted-pair wires that are twisted together. **Coaxial cable** consists of a single copper wire surrounded by at least three layers (insulating material, woven or braided metal, and a plastic outer coating). **Fiber-optic cable** consists of dozens or hundreds of thin strands of glass or plastic that use light to transmit signals. Wireless transmission media, which send communications signals through air or space, include broadcast radio, cellular radio, microwaves, communications satellites, and infrared. **Broadcast radio** distributes radio signals through the air over long distances. **Cellular radio** is a form of broadcast radio used widely for mobile communications. **Microwaves** are radio waves that provide a high-speed signal transmission. A **communications satellite** is a space station that receives microwave signals from an earth-based station, amplifies the signals, and broadcasts the signals back over a wide area to any number of earth-based stations. **Infrared (IR)** sends signals using infrared light waves.

Key Terms

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch9/terms.htm. Scroll through the list of terms. Click a term to display its definition and a picture. Click the To WEB button for current and additional information about the term from the Web. To see animations, Shockwave and Flash Player must be installed on your computer (download by clicking here).

ADSL (asymmetric digital subscriber line) (9.26)
analog signal (9.3)
anonymous FTP (9.24)
asynchronous (9.7)
asynchronous transfer mode (ATM) (9.27)
backbone (9.17)
bandwidth (9.31)
baseband (9.32)
bits per second (bps) (9.26)
Bluetooth™ (9.35)
broadband (9.32)
broadband modem (9.29)
broadcast radio (9.35)
bus (9.17)
bus network (9.17)
cable modem (9.29)
cellular radio (9.36)
cellular telephone (9.36)
channel (9.31)
chat room (9.6)
client/server (9.14)
clients (9.14)
coax (9.33)
coaxial cable (9.33)
collaborate (9.9)
communications (9.2)
communications device (9.27)
communications satellite (9.38)
communications software (9.23)
database server (9.14)
dedicated line (9.25)
dedicated servers (9.14)
demodulate (9.28)
dial-up line (9.25)
dial-up modem (9.28)
Digital Angel™ (9.11)
digital modem (9.28)
digital signal (9.3)
downlink (9.39)
DSL (digital subscriber line) (9.26)
DSL modem (9.28)
e-mail (electronic mail) (9.5)
Ethernet (9.18)
external modem (9.28)
extranet (9.20)
Fast Ethernet (9.19)
fax (9.5)
fiber-optic cable (9.34)
file server (9.14)
firewall (9.20)
FTP (file transfer protocol) (9.24)
FTP server (9.24)
Gigabit Ethernet (9.19)
gigabits per second (Gbps) (9.26)
global positioning system (GPS) (9.10)
groupware (9.10)
home network (9.22)
HomePLC (powerline cable) network (9.22)
HomeRF (radio frequency) network (9.22)
host computer (9.14)
hub (connecting networks) (9.30)
hub (star network) (9.18)
infrared (IR) (9.39)
instant messaging (IM) (9.6)
intelligent home network (9.23)
internal modem (9.28)

COMMUNICATIONS SATELLITE

Space station that receives microwave signals from an earth-based station, amplifies (strenghtens) the signals, and broadcasts the signals back over a earth-based stations. (9.38)

Internet appliance (9.4)
Internet telephone software (9.8)
Internet telephony (9.8)
intranet (9.20)
ISDN (Integrated Services Digital Network) (9.26)
ISDN adapter (9.28)
ISDN modem (9.28)
kilobits per second (Kbps) (9.26)
LAN adapter (9.29)
line-of-sight transmission (9.37)
local area network (LAN) (9.12)
megabits per second (Mbps) (9.26)
metropolitan area network (MAN) (9.16)
microwave station (9.37)
microwaves (9.37)
modem (9.28)
modulate (9.28)
multiplexing (9.26)
network (9.11)
network administrator (9.14)
network interface card (NIC) (9.29)
network operating system (9.12)
network OS (9.12)
network server (9.14)
network topology (9.16)
newsgroup (9.7)
noise (9.33)
NOS (9.12)
online meeting (9.9)
optical fiber (9.34)
P2P (9.16)
packet switching (9.20)
packets (9.19)
peer-to-peer (9.13)
Personal Communications Services (PCS) (9.37)
phoneline network (9.22)
physical transmission media (9.32)
powerline LAN (9.22)
print server (9.14)
public switched telephone network (PSTN) (9.25)
radio chats (9.7)
receiving device (9.2)
ring network (9.17)
routers (9.19)
sending device (9.2)
server (9.14)
site license (9.11)
star network (9.18)
synchronous (9.7)
T1 line (9.27)
T3 line (9.27)
T-carrier line (9.27)
threaded discussion (9.7)
token ring (9.19)
transceiver (9.35)
transfer rate (9.26)
transmission control protocol/Internet protocol TCP/IP (9.19)
transmission media (9.31)
twisted-pair cable (9.33)
twisted-pair wire (9.33)
uplink (9.39)
video chats (9.7)
video telephone call (9.8)
videoconference (9.8)
voice chats (9.7)
voice mail (9.4)
voice mailbox (9.4)
WAP-enabled devices (9.20)
Web appliance (9.4)
Web conference (9.8)
Web-enabled device (9.4)
wide area network (WAN) (9.15)
Wireless Application Protocol (WAP) (9.20)
wireless LAN (WLAN) (9.12)
wireless modem (9.28)
wireless transmission media (9.32)
workgroup computing (9.10)

Learn It Online

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch9/learn.htm.

1. Web Guide

Click Web Guide to display the Guide to World Wide Web Sites and Searching Techniques Web page. Click Reference and then click Webopedia. Search for Networks. Click one of the Networks links. Use your word processing program to prepare a brief report on your findings and submit your assignment to your instructor.

2. Scavenger Hunt

Click Scavenger Hunt. Print a copy of the Scavenger Hunt page; use this page to write down your answers as you search the Web. Submit your completed page to your instructor.

3. Who Wants to Be a Computer Genius?

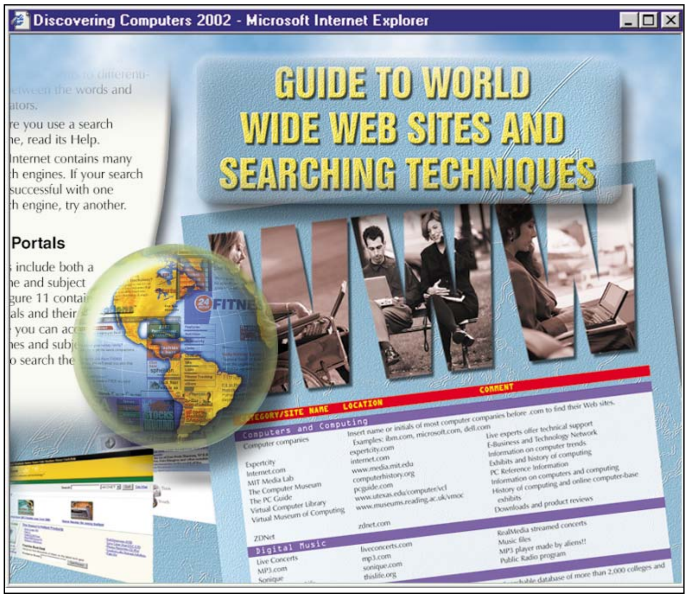
Click Computer Genius to find out if you are a computer genius. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit your score to your instructor.

4. Wheel of Terms

Click Wheel of Terms to reinforce important terms you learned in this chapter by playing the Shelly Cashman Series version of this popular game. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit your score to your instructor.

5. Career Corner

Click Career Corner to display the About.com page. In the Find It Now text box, type `distance learning`. Scroll through the results and then click a link related to technology learning online. Write a brief report on what you discovered. Submit the report to your instructor.


Discovering Computers 2002 - Microsoft Internet Explorer
GUIDE TO WORLD WIDE WEB SITES AND SEARCHING TECHNIQUES
Portals
CATEGORY/SITE NAME
LOCATION
COMMENT
Computers and Computing
Digital Music

6. Search Sleuth:

Click Search Sleuth to learn search techniques that will help make you a research expert. Submit the completed assignment to your instructor.

7. Crossword Puzzle Challenge

Click Crossword Puzzle Challenge. Complete the puzzle to reinforce skills you learned in this chapter. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit the completed puzzle to your instructor.

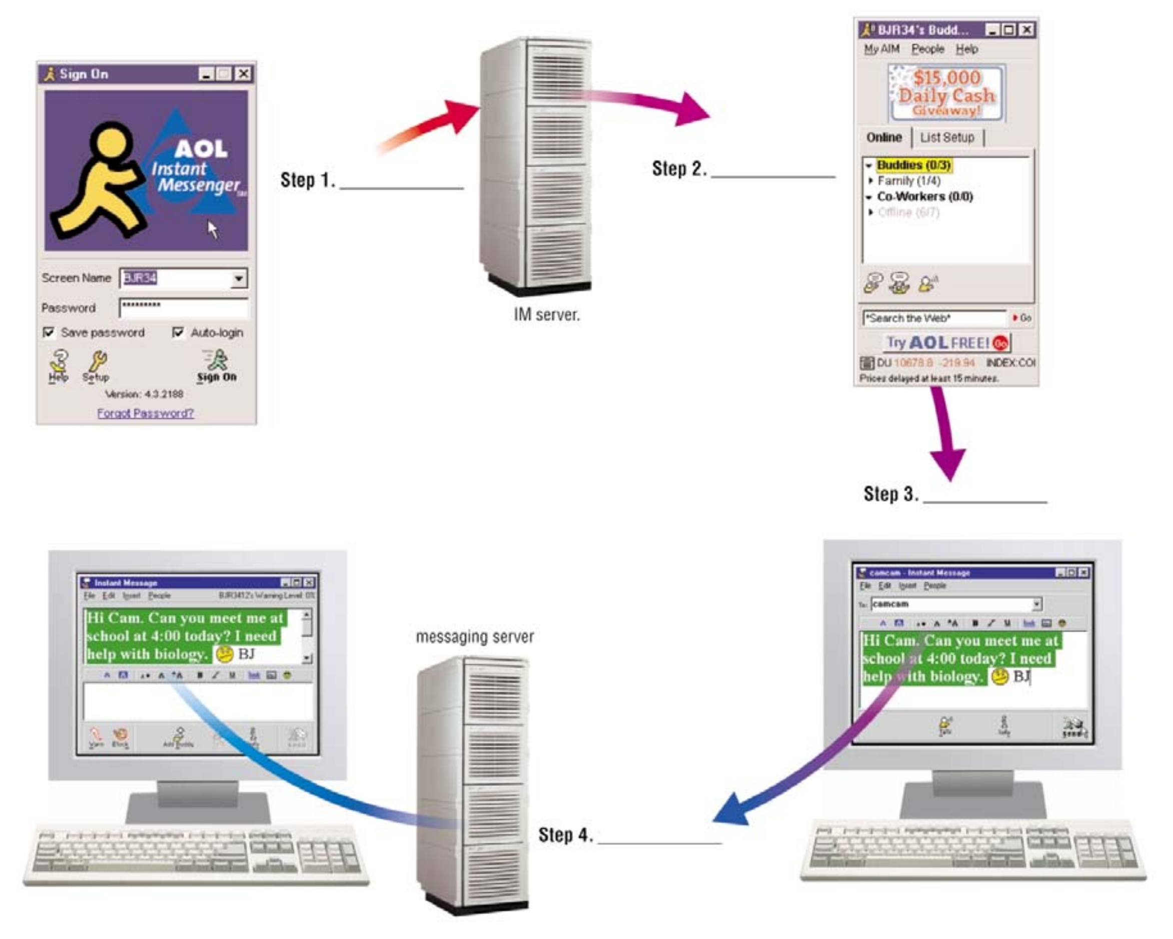
8. Practice Test

Click Practice Test. Answer each question. When completed enter your name and click the Grade Test button to submit the quiz for grading. Make a note of any missed questions. If required, print a copy to submit to your instructor.

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch9/check.htm. Click the links for current and additional information. To experience the animation and interactivity, Shockwave and Flash Player must be installed on your computer (download by clicking here).

LABEL THE FIGURE

Instructions: Identify the steps in this example of instant messaging.



Screen Name BJR34
Password *********
☑ Save password ☑ Auto-login
Version: 4.3.2188
Forgot Password?

Hi Cam. Can you meet me at school at 4:00 today? I need help with biology. BJ

MATCHING

Instructions: Match each term from the column on the left with the best description from the column on the right.

_______ 1. coaxial cable
_______ 2. cellular radio
_______ 3. microwave
_______ 4. fiber-optic cable
_______ 5. twisted-pair cable

a. Two separate insulated copper wires that are twisted together.
b. A single copper wire surrounded by at least three layers.
c. A space station that receives microwave signals.
d. Radio waves that provide a high-speed signal transmission.
e. A form of broadcast radio that is used widely for mobile communications.
f. A wireless transmission media that sends signals using infrared light waves.
g. Consists of dozens or hundreds of thin strands of glass or plastic that use light to transmit signals.

MULTIPLE CHOICE

Instructions: Select the letter of the correct answer for each of the following questions.

1. A(n) ___________ consists of a continuous electrical wave.
   a. digital signal
   b. analog signal
   c. GPS
   d. bus
2. A ___________ network covers a large geographical area.
   a. local area
   b. metropolitan area network
   c. peer-to-peer
   d. wide area
3. In a ___________ network, all of the devices in the network connect to a central computer.
   a. star
   b. bus
   c. ring
   d. peer-to-peer
4. A(n) ___________ is an internal network that uses Internet technologies.
   a. extranet
   b. intranet
   c. wide area network
   d. metropolitan area network
5. ___________ is an Internet standard that allows you to upload and download files to and from a Web server.
   a. FTP
   b. TCP/IP
   c. WAP
   d. PSTN

SHORT ANSWER

Instructions: Write a brief answer to each of the following questions.

1. What is noise? ___________ Why do most of today's networks not use cable? ___________
2. How are analog signals different from digital signals? ___________ Why must both the sending and receiving ends of some communications channels have a modem for data transmission to occur? ___________
3. What is a network operating system (NOS)? ___________ What tasks does a network operating system perform? ___________
4. How is a peer-to-peer network different from a client/server network? ___________ What is the role of a network administrator? ___________
5. What is network topology? ___________ How are bus networks, ring networks, and star networks different? ___________

WORKING TOGETHER

Instructions: Working with a group of your classmates, complete the following team exercise.

Assume you are part of a group hired as consultants to recommend a network plan for a small company of 20 employees. Using the Internet and other available resources, develop a network plan for the company. Include the following components in your plan: (1) the type of network — peer-to-peer or client/server; (2) the suggested topology; (3) the type and number of servers; (4) the peripheral devices; and (5) the communications media. Prepare a written report and a PowerPoint presentation to share with the class.

In The Lab

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch9/lab.htm. Click the links for current and additional information.

Understanding Your Modem

1

This exercise uses Windows 95 or Windows 98 procedures and requires that you have a modem. Click the Start button on the taskbar, point to Settings on the Start menu, and then click Control Panel on the Settings submenu. Double-click the Modems icon in the Control Panel window. When the Modems Properties dialog box displays, click the General tab and then click the Properties button. Answer the following questions:

- What is the name of the modem?
- To which port is the modem connected?
- What is the maximum speed of the modem?
- Click the Connection tab and then answer the following questions:
- What is the number of data bits?
- What is the parity?
- What is the number of stop bits?
- Which call preferences (if any) are set on your modem?

Click the Cancel button to close each dialog box, and then click the Close button to close the Control Panel window.

Phone Dialer

2

This exercise uses Windows 98 or Windows 2000 procedures. Click the Start button on the taskbar and then click Help on the Start menu. When the Windows Help window opens, click the Index tab. Type `phone dialer` in the Type in a keyword to find text box and then click the Display button to learn about using Phone Dialer to dial from your computer. What is Phone Dialer? How do you start Phone Dialer after clicking the Start button? How can you obtain information about how to use Phone Dialer? Click the Close button to close the Windows Help window.

Network Access

3

This exercise uses Windows 95 or Windows 98 procedures. Double-click the My Computer icon on the desktop. Double-click the Control Panel icon in the My Computer window. Double-click the Network icon in the Control Panel window. When the Network dialog box displays, click the Identification tab. What is the Computer name? What is the Workgroup? What, if any, is the Computer Description? Click the Access Control tab. How is Share-level access control different from User-level access control? Click the Close button to close the Network dialog box and the Control Panel window.

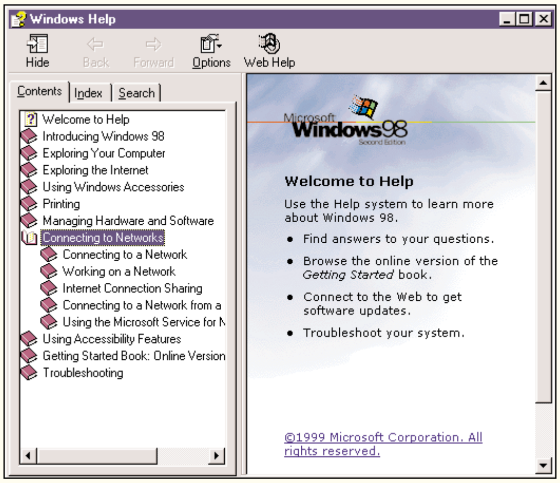
Using Help to Understand Networks

4

This exercise uses Windows 98 procedures. Click the Start button on the taskbar and then click Help on the Start menu. Click the Contents tab. Click the Connecting to Networks book. Click the Connecting to a Network book. Click an appropriate Help topic to answer the following questions:

- How do you log on to a network?
- How do you connect to another computer on your network?
- How do you log off the network?

Click the Close button to close the Windows Help window.


Windows Help
Hide
Back
Forward
Options
Web Help
Contents
Index
Search
Welcome to Help
Introducing Windows 98
Exploring Your Computer
Exploring the Internet
Using Windows Accessories
Printing
Managing Hardware and Software
Connecting to Networks
Connecting to a Network
Working on a Network
Internet Connection Sharing
Connecting to a Network from a
Using the Microsoft Service for N
Using Accessibility Features
Getting Started Book: Online Version
Troubleshooting
Microsoft Windows98 Second Edition

Welcome to Help

Use the Help system to learn more about Windows 98.

- Find answers to your questions.
- Browse the online version of the *Getting Started* book.
- Connect to the Web to get software updates.
- Troubleshoot your system.

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Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch9/web.htm. To view At The Movies in exercise 1, RealPlayer must be installed on your computer (download by clicking here). To use the Shelly Cashman Series Exploring the Computers of the Future Lab from the Web, Shockwave and Flash Player must be installed on your computer (download by clicking here).

Distracted Drivers

To view the Distracted Drivers movie, click the button to the left or click the Play button to the right. Watch the movie, and then complete the exercise by answering the questions below. Technology-based driving distractions are responsible for 20 to 30 percent of the approximately six million accidents recorded each year. Radios, CD players, and especially cellular telephones have been the major culprits; however, new on-board navigational apparatus, many of them handheld devices, threaten to escalate the problem exponentially. Auto manufacturers are developing new safety features in response, but the growing convergence of technologies continues to spawn new systems and devices. Are strict laws against using these devices while driving the answer? Should laws be enacted that regulate carmakers or the device makers? What are other solutions?

Shelly Cashman Series Exploring the Computers of the Future Lab

Follow the instructions in Web Work 2 on page 1.47 to start and use the Shelly Cashman Series Exploring the Computers of the Future Lab. If you are running from the Web, enter the URL, scsite.com/sclabs/menu.htm or display the Web Work page (see instructions at the top of this page) and then click the button to the left.

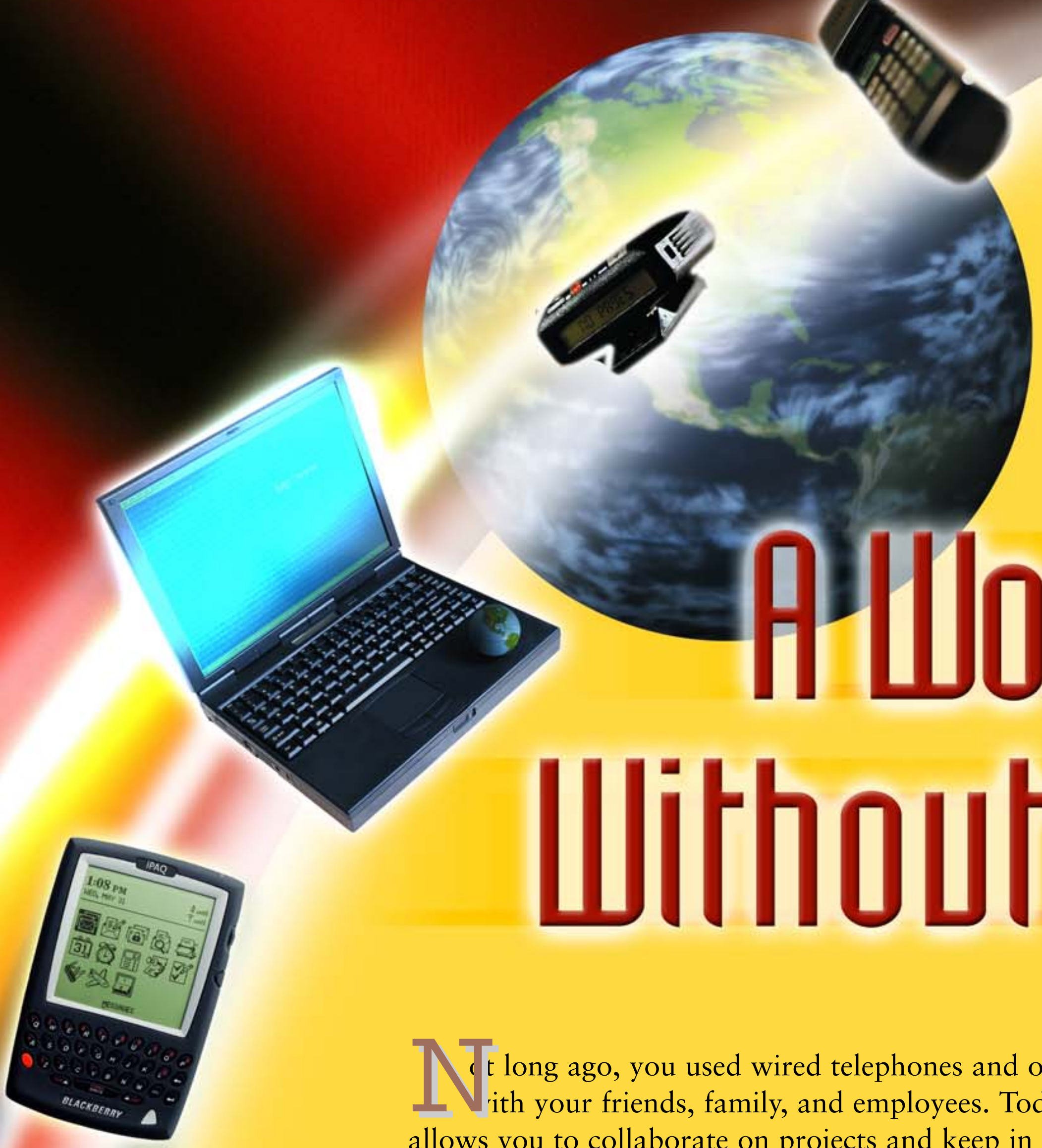
Attachments

People often attach files to e-mail messages. To send an e-mail message with an attachment, click the button to the left to display your e-mail service. Enter your Login Name and Password. When the In-Box screen displays, click Compose. Type a classmate's e-mail address in the To text box and then type `Attachments` in the Subject text box. Click the Attachments button. Insert your floppy disk in drive A. Type `a:\h7-2.doc` in the Attach File text box. This is the document you create to complete Chapter 7 In the Lab 2. Click Attach to Message. Click the Done button. Click in the message box and then type a brief message about which E-Revolution applied question the attached document answers. When you are finished, click the Send button. Click the OK button on the Compose: sent Message Confirmation screen. Read any newly arrived mail. When you have read all of your messages, click Log Out to quit the e-mail service.

In the News

Theoretically, business travelers can access e-mail, fax documents, and transmit data from anywhere in the world. In practice, however, incompatible telephone standards and mismatched telephone jacks can frustrate even experienced globetrotters. 3Com's Megahertz International PC Card addresses this problem. The modem and accompanying software allow travelers to use computer communications with more than 250 telephone systems simply by selecting the appropriate country from a menu and attaching a suitable adapter plug. Click the button to the left and read a news article about a product that is changing computer communications. What is the product? What does it do? Who is more likely to use this product?

www.scsite.com/dc2002/ch9/wireless.htm



A World Without Wires

Not long ago, you used wired telephones and other devices to communicate with your friends, family, and employees. Today, wireless technology allows you to collaborate on projects and keep in touch with friends and family from anywhere in the world using a variety of gadgets: a smart pager, a cellular telephone, a handheld computer, and a notebook computer with high-speed Internet access. You also have the technology to check your e-mail as you travel throughout your town or the world.

Wireless networks are springing up everywhere, driven by convenience, cost, and access. Indeed, the wireless evolution is taking the world by storm. Even the casual observer notices dramatic changes in the way computer users send e-mail and communicate, access the Internet, and create and share files in the office. Your pockets and backpack may be overflowing with small electronic devices, but the wireless revolution is making headway to combine some of these products and simplify your life.

Today's wireless technology represents an evolution of products and standards. This special feature looks at a wide variety of these wireless products and illustrates how this technology is being used to simplify and expand your communication abilities.

Web Instructions: *To gain World Wide Web access to additional and up-to-date information regarding this special feature, start your browser and enter the URL shown at the top of this page.*

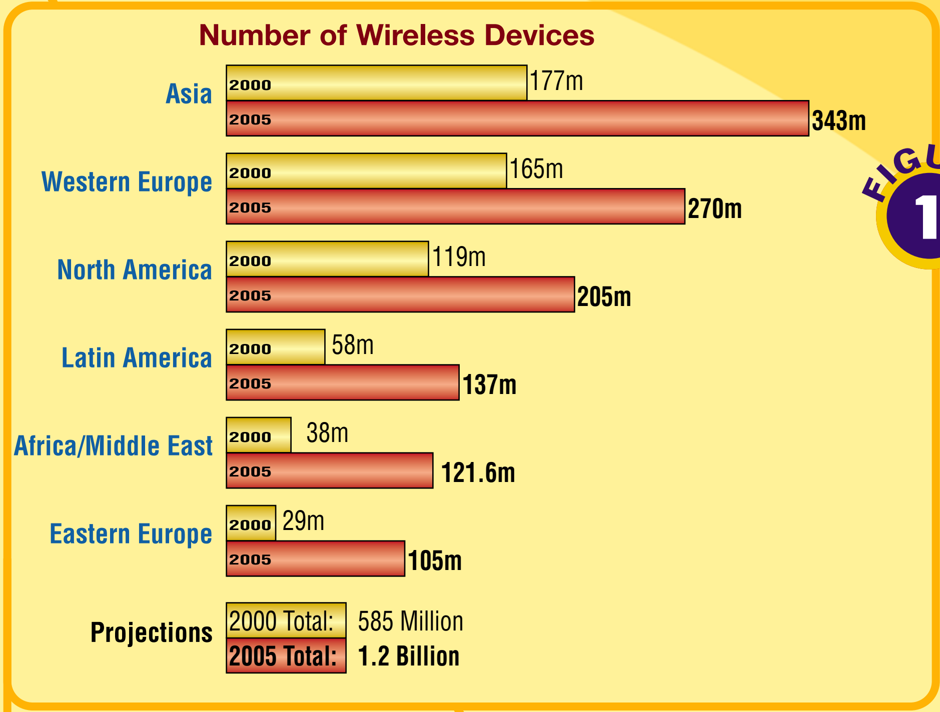


FIGURE 1

Today's technological changes are just the beginning of our fast-paced expansion into the wireless domain. Asia and Western Europe have emerged as world leaders in wireless device use. By 2005, more than 1.2 billion wireless devices will be in use, with millions of these products able to access the entire Web wirelessly.

FIGURE 2

Messaging is the foremost reason for the wireless market explosion. Wireless links to corporate networks allow employees to connect their cellular telephones, notebook computers with wireless Web modems, and handheld computers, and access their e-mail and key applications. Today, more than 170 million people worldwide send more than 3 billion messages per month. Analysts expect these numbers to surge by 2004, estimating that more than 1.3 billion people will send 244 billion messages monthly.

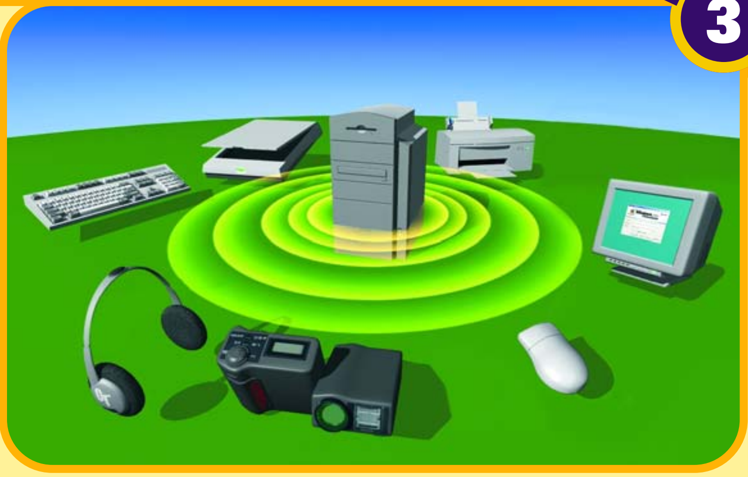


FIGURE 3

Wireless desktop computer components eliminate tangled cords and provide flexibility and freedom of movement. Digital radio technology allows peripherals, such as cordless pointing devices and keyboards, to work in a short range without being pointed at the computer.

FIGURE 4

Your wireless telephone is no longer just a telephone. At home, it serves as a portable telephone with a fixed line charge. On the road, it works as a mobile telephone with cellular charges. When it is in range of another telephone with Bluetooth™ wireless technology, it functions as a two-way radio. These devices also may contain other features, such as the ability to send text messages, a microbrowser to access the Internet, a speakerphone, and a wireless modem that can connect to a compatible handheld computer or notebook computer.

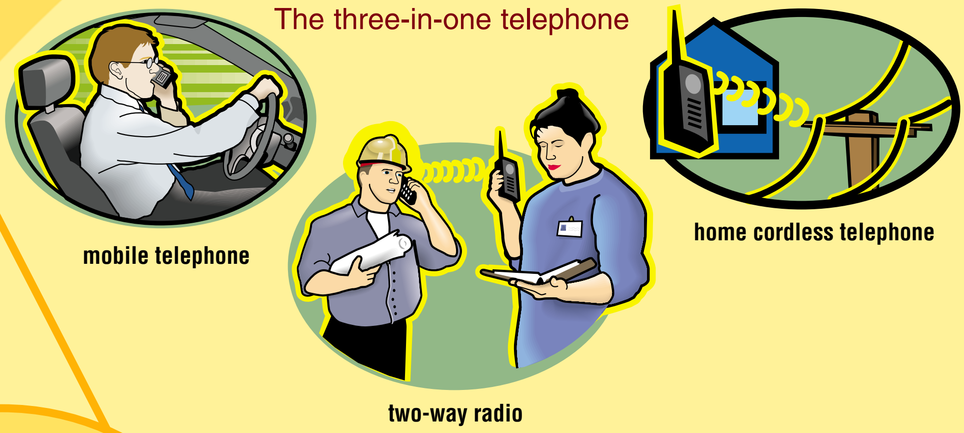
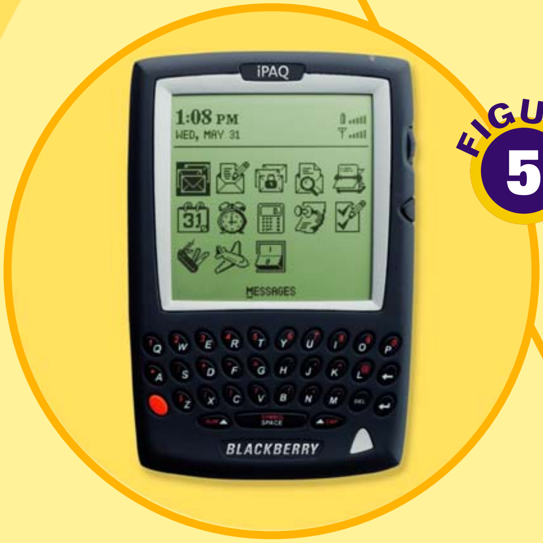


FIGURE 5



Compaq iPAQ BlackBerry users can access their e-mail at all times because they always are connected to a wireless network. They can watch e-mail messages scroll by while waiting for a bus, sitting in a meeting, taking coffee breaks, or studying with friends. Users also can compose, forward, and reply to messages.

FIGURE 6

Today's smart pagers are small and relatively inexpensive. Compared to cellular telephones, they have a longer battery life, lower access fee, and smaller size. Many provide instant messaging capability. Some computer experts consider Internet instant messaging (IM) the e-mail of the new millennium. Interactive pagers provide two-way messaging, information managers, and news, sports, and stock updates. Depending on the subscription service, some allow users to execute stock trades and make purchases, such as airline tickets.

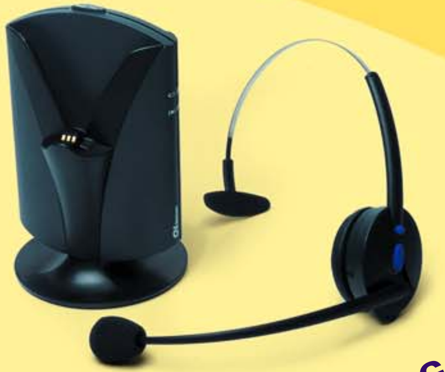


FIGURE 7

Ericsson introduced the first Bluetooth™ product in 2000 — a headset that communicates with a wireless telephone, thus enabling users to talk hands-free. Wireless headsets also can connect to notebook computers and handheld computers.

FIGURE 8

United, American, and Delta airlines have set up high-speed wireless access at their main hubs and select international airports. This wireless infrastructure may improve productivity by having employees use the network while waiting for airplanes. The three airlines recognize that passengers travel with notebook computers, and with wireless access available, these customers can accomplish routine tasks such as accessing the Internet.

FIGURE 9

Wireless technology revolutionizes the way we learn and interact. During meetings, employees can use their wireless notebook computers, e-mail devices, and handheld computers to exchange electronic documents, business cards, schedules, and photos with all the people in the room or with selected participants. They even can transmit their documents to a data projector.

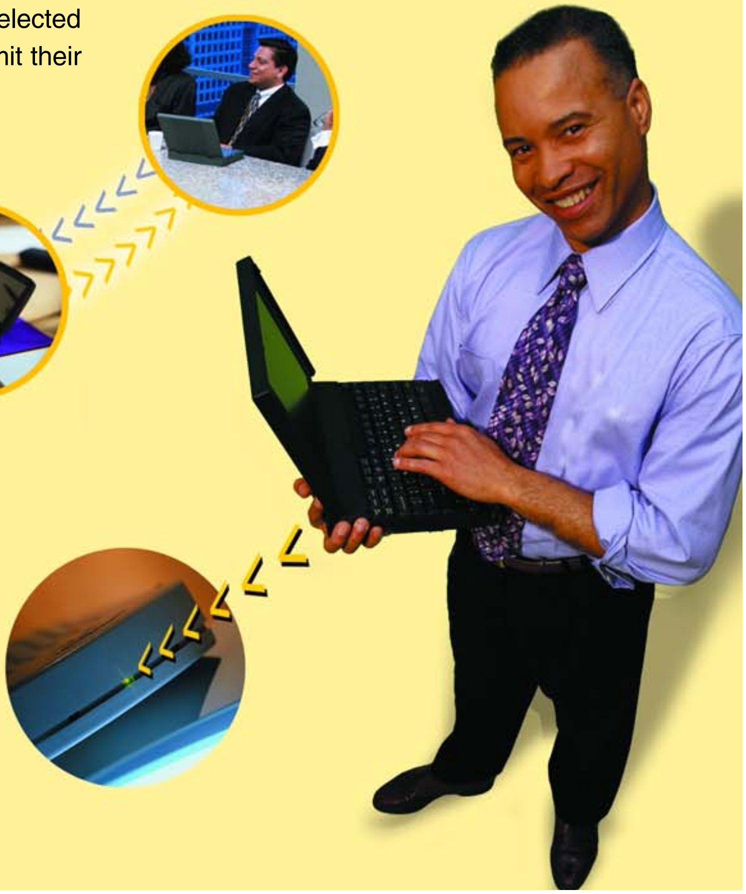


FIGURE 10

Wireless connectivity makes it easy to synchronize files on your handheld computers and notebook computers. When you are on the road, you can connect your wireless devices to an office network and automatically transfer databases, appointments, to-do lists, and other files, just as if you were seated in front of your computer. Back in the office, you can update your notebook computer and handheld computer the instant you enter the room.

scsite.com/dc2002/ch9/wireless.htm

FIGURE 11

Your friend is vacationing in sunny Hawaii; you are shoveling snow in frigid Chicago. You can bask in your friend's warmth with instant postcards. All your friend needs to do is capture an image with a digital camera, connect the camera to a mobile telephone, and transmit the postcard to you. In seconds, you will receive the image on your notebook computer that is connected wirelessly to your mobile telephone.

FIGURE 12

Millions of hikers, boaters, pilots, drivers, and other navigators never feel lost with the aid of global positioning system (GPS) devices. These products rely on 24 satellites that circle the Earth twice a day in a very precise orbit and transmit data to Earth. The GPS products then use 3 to 12 of these satellites to determine the receivers' precise geographic locations. Some GPS devices include color mapping capability that gives detail for any United States city. GPS modules also are available for handheld computers. By the middle of this decade, analysts predict that 25 million vehicles, including all new cars, will be equipped with GPS navigational devices.

FIGURE 13

Instructors now can determine just how well students are comprehending class material with the help of interactive wireless computers. They can ask a multiple-choice or true-false question and then ask students to respond using a wireless keypad resembling a remote control. Within seconds, an infrared reader captures the students' responses, and then a computer tabulates the results, and tracks their scores.

Wireless technological changes are affecting the ways you communicate with colleagues and relatives throughout the world. Each day, the number of wireless devices increases as the price of connectivity decreases. Indeed, you are taking part in the wireless revolution sweeping the world.